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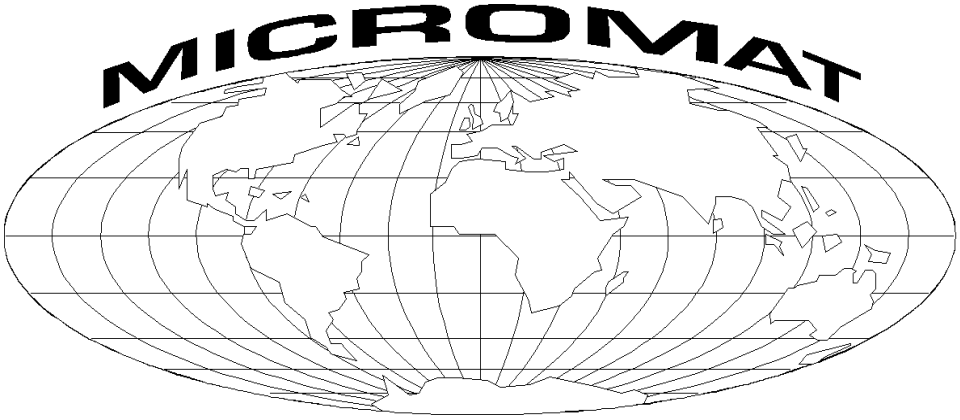


# MICROMAT
# PCB DRILLING SYSTEM

## USER MANUAL

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# MICROMAT
# PCB DRILLING SYSTEM

## INTRODUCTION

Welcome to the Micromat World of Drilling. If you are an existing Micromat user you will already be aware of the advanced features and concepts of the Micromat control system.

The Model 1575 takes those features a step further in usability. This screen based control system provides an unequalled clarity of comprehension and with direct CAD disk compatibility there should be no circuit boards that you cannot process.

The disk input facilities can handle all formats of CAD drill data and include a graphic positioning system to handle those awkward files.

The system is equipped with a fast, efficient, drill path optimiser to further enhance your productivity.

Routing profiles can be programmed very quickly and will show a considerable time saving over conventional sawing or pin routing methods, especially in the case of small irregular shapes.

The Micromat controller can be programmed either manually, or by loading the drill data directly from disk. Drilling and routing programs are saved on floppy disk or can be transferred to a central computer system via a Local Area Network.

As with any computer-controlled machine, the Micromat will only do what the operator tells it to do, so in order to obtain the best results it's operation must be fully understood by the operator.

The following instructions should be read carefully, using the machine for reference, until the procedures become familiar. It is not necessary to actually drill anything to become aware of the machine's capabilities since use of the CHECK mode allows programs to be entered and visually inspected with the built in TV system. This not only provides a valuable training aid, but also a necessary testing facility for any entered programs prior to actual drilling or routing operations.

The Auto Tool Change version offers improved output and accuracy since the boards do not have to be removed between runs of different drill sizes.

# ROUTINE SERVICING

The only basic attention required by the Micromat is that it is kept clean and free from dust and grease.

The swarf extraction unit should be emptied at least daily and the filter bags well shaken to avoid dust clogging and subsequent overheating and destruction of the motor. The motor brushes should be inspected monthly and replaced if required.

The X and Y axis bearings are accessible beneath the blinds and should be inspected regularly, wiped with lint free cloth and lightly oiled.

The spindle should have its collet completely removed daily and any traces of dust cleaned from it and its housing. A build up of dust will cause off-centre rotation, poor quality holes and a rapid destruction of the spindle bearings and probably defective or failed tool changing on the auto tool change machines. When replacing the collet ensure that the keyway on the collet engages with the pin in its housing.

From time to time, check that all connectors are secure and that connecting cables are not frayed in any way.

## INSTALLATION

The drill mechanics should be securely mounted on a flat, rigid surface in order to maintain the machine's accuracy.

Electrical supplies should be from a direct connection to the main power source of the building with no other equipment of any kind connected to the same line.

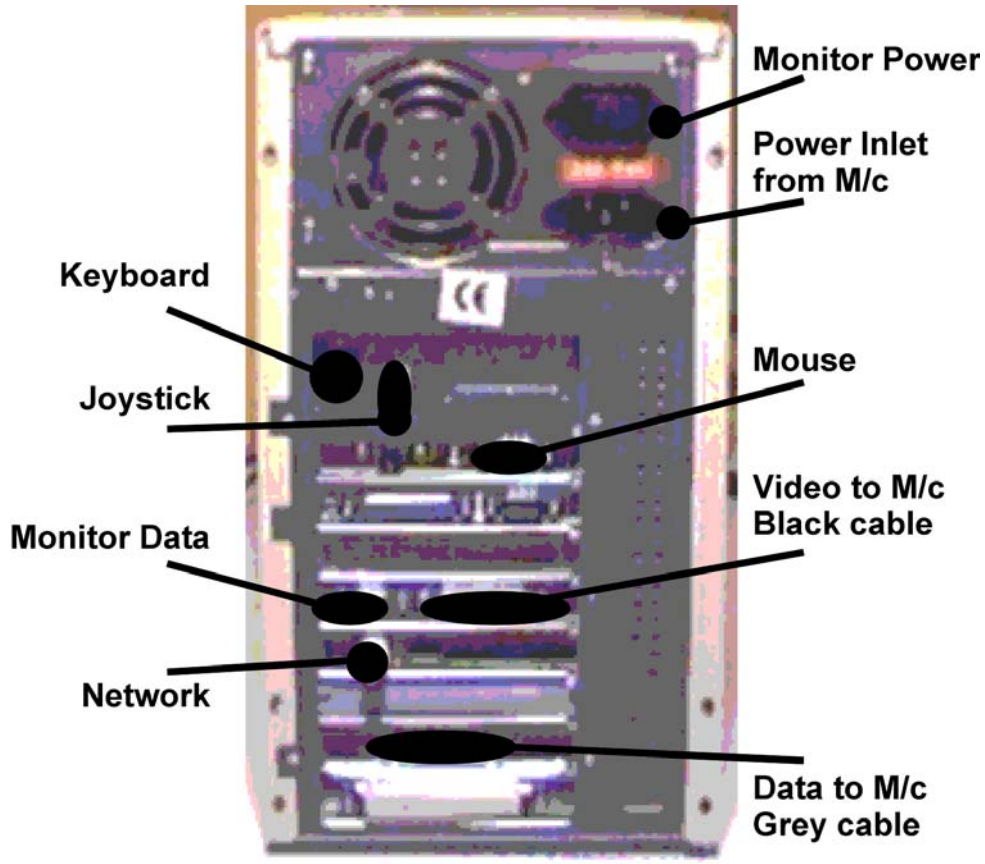
A good electrical ground connection must be made to the machine both to reduce electric shock hazard and to help prevent electrical disturbances from affecting the operation of the machine.

In some areas it may be necessary to use a power supply filter / regulator unit to prevent power line interference.

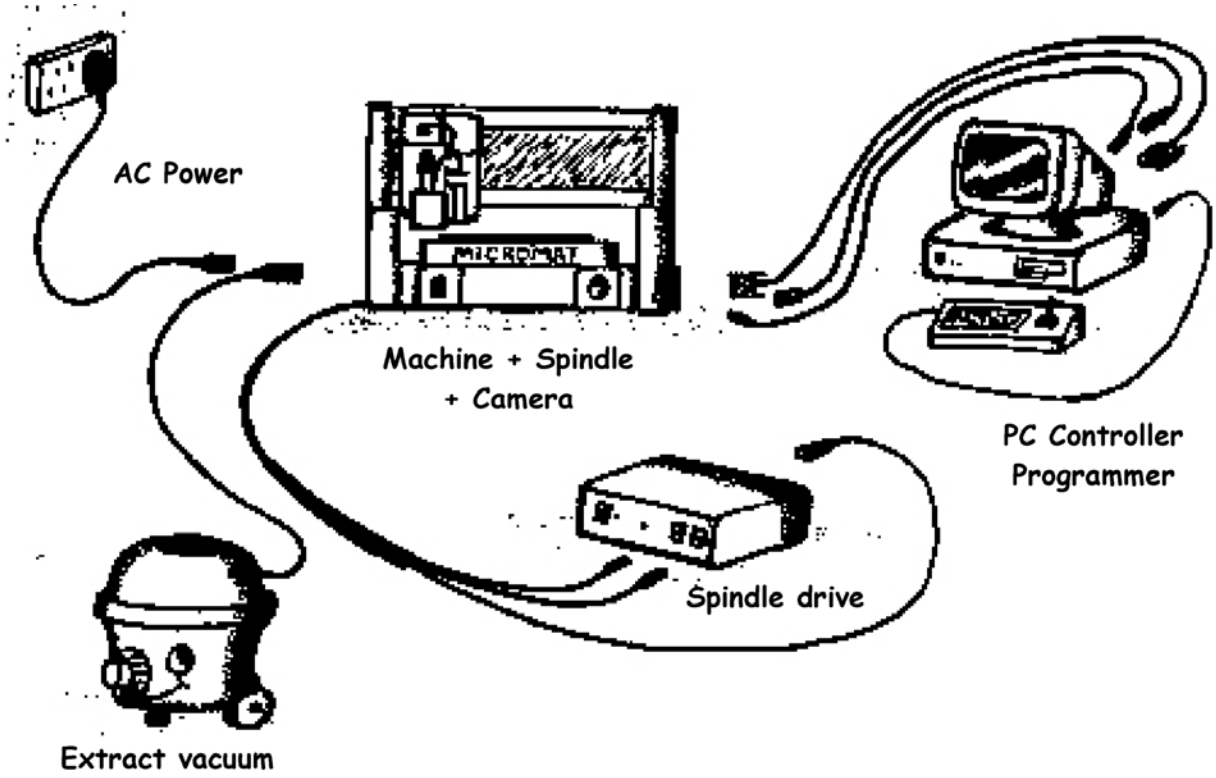
Although the Micromat will operate under a wide variety of conditions it should not be subjected to extremes of temperature as this will obviously affect its accuracy.

Temperature changes will also affect the size of any laminate being used. Normal operation should be at or about 65 degrees Fahrenheit (18 degrees Celsius).

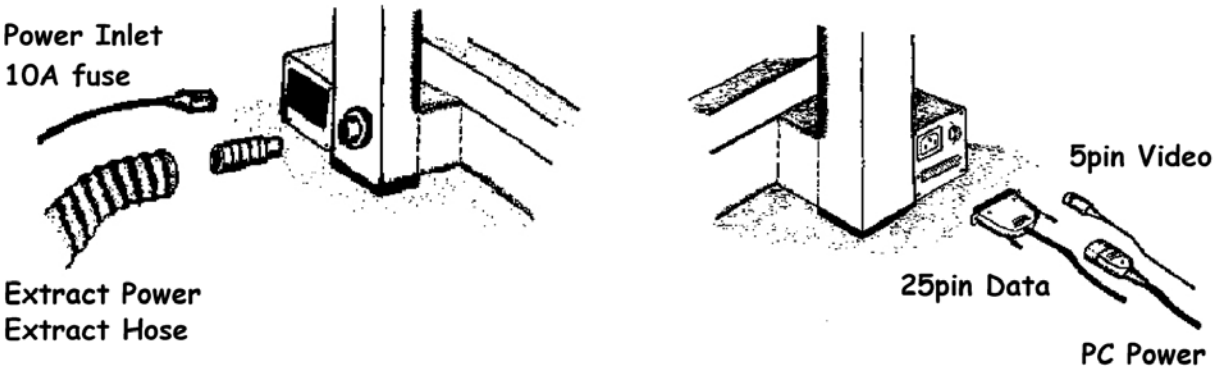
## PC CONNECTIONS

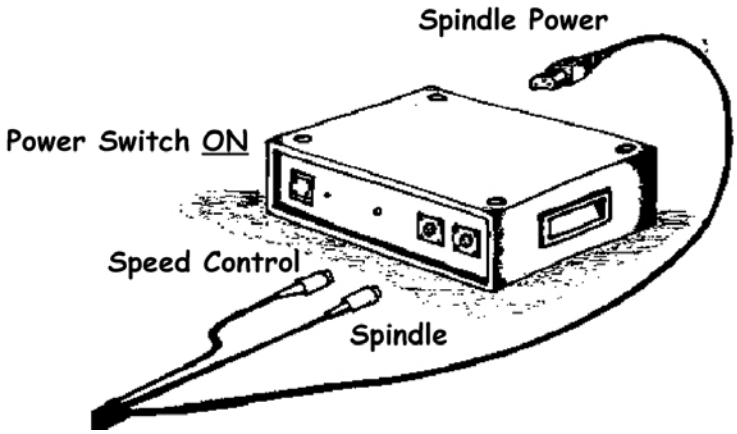


**INTERCONNECTIONS**
MM300 / 500 machines




## General Wiring

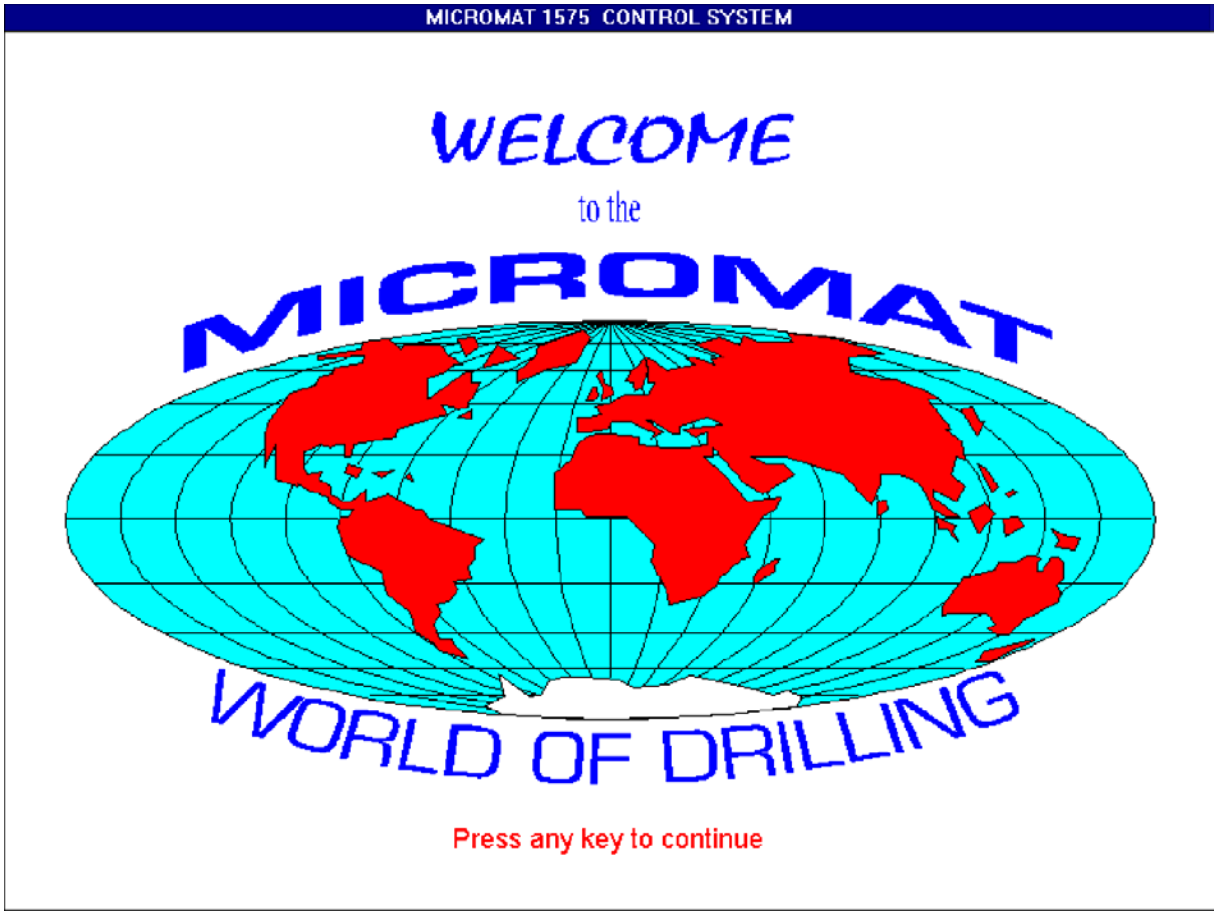


# GETTING STARTED

Check that the system has been connected in accordance with the appropriate interconnections diagram. Make sure that there are no floppy disks in drive A or B and then switch on power to both the machine and the control system. The control system will perform some self-test procedures and information will appear on the screen while this takes place. Please don't press any keys at this point. After a few moments, the Micromat Welcome screen will be shown
and a number will countdown from 10 to 1 while the control system is loaded and configured.

The complete start-up procedure will take about two minutes and at the end of the process the screen will display "Press any key to continue".




Press any key to continue and the MENU screen will be shown.

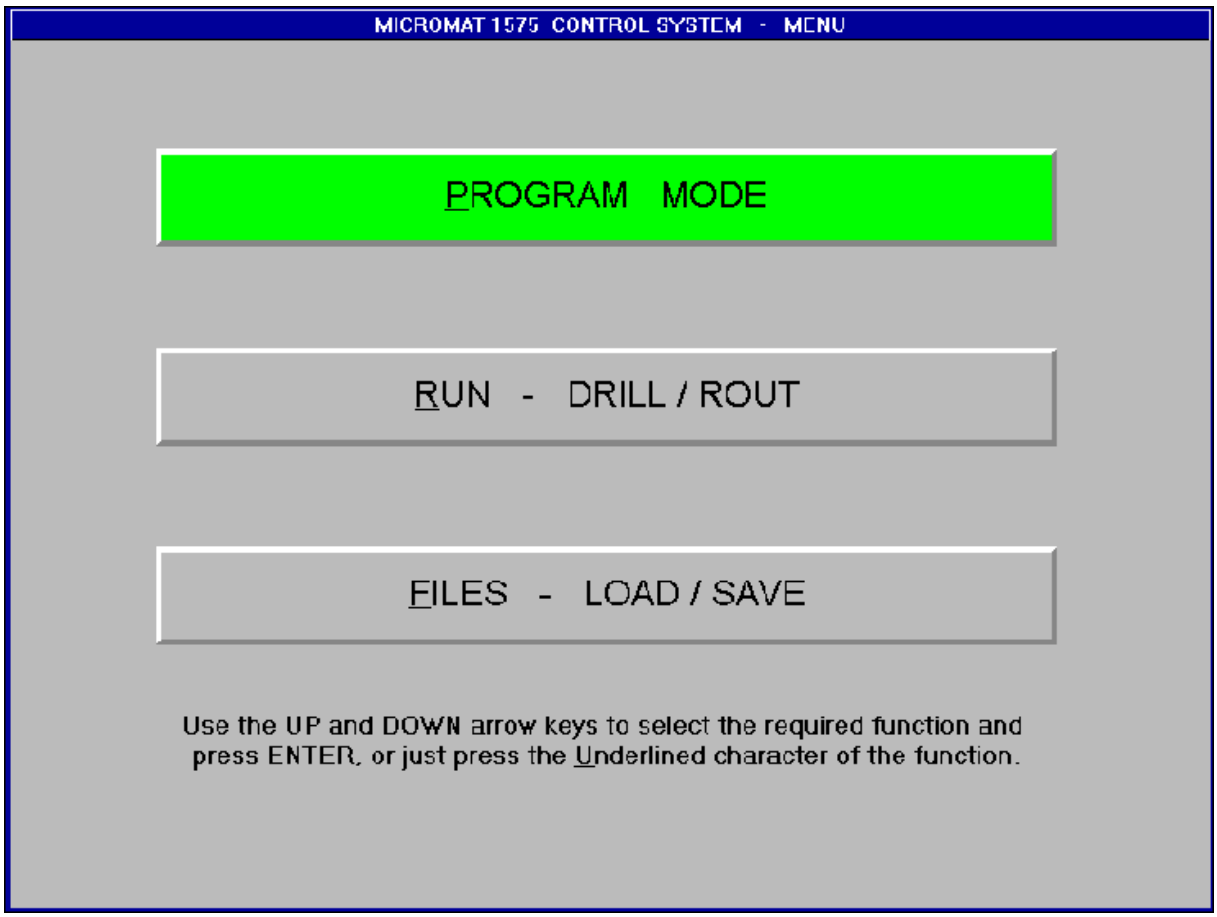
# MENU SCREEN

This is the central point of the control system and any of the three screens through which the system is controlled may be accessed from here. All the functions of the Micromat control system are accessed through either the **Program**, **Run** or **Files** screen, making the system simple to learn and easy to remember.

To select a function use the **up** and **down** arrow keys located at the lower right hand side of the keyboard to move the green highlight to the required selection button, then press **Enter**.

An alternate method is to press the character key corresponding to the underlined character shown on the selection button.

i.e. **P** for **P**ROGRAM **R** for **R**UN or **F** for **F**ILES


MICROMAT 1575 CONTROL SYSTEM - MENU
PROGRAM MODE
RUN - DRILL / ROUT
FILES - LOAD / SAVE
Use the UP and DOWN arrow keys to select the required function and press ENTER, or just press the Underlined character of the function.

If you are ever unsure about what you may do, on-screen help is available at all times and is accessed by pressing the **F1** key at the top of the keyboard.

We recommend that you follow the rest of this manual as a tutorial and ask you to remember that this is a screen based system and all you need to know will be shown on the screen in front of you. So please take the time to **LOOK** at the screens and **READ** the information they contain. It will save you a lot of time and frustration!

# THE PROGRAM SCREEN

Select Program from the Menu screen by using the ***Up*** and ***Down*** arrow keys to move the highlight to the required function and press Enter. Alternatively just press the underlined character of the function. i.e. **P for PROGRAM.**

The Program screen is used to manually enter or edit a drilling or routing program and to check the accuracy of data which may have been loaded from floppy disk.

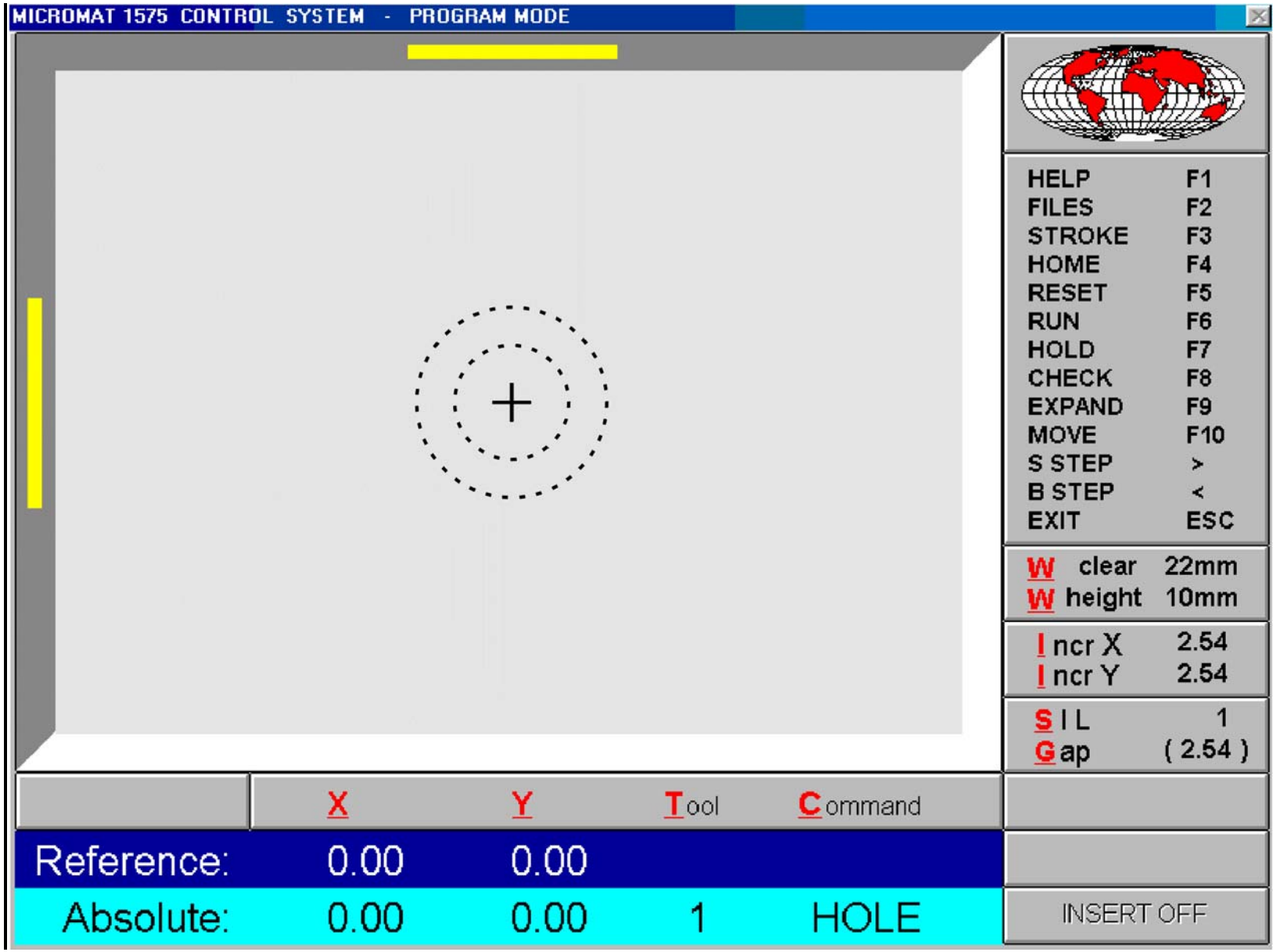
The screen consists of the TV camera picture, a function menu panel to the right and an information panel below. The TV picture contains a round target display to allow accurate positioning. The size and colour of the target is operator adjustable to suit individual preferences.

The menu functions are operated directly from the keyboard by pressing the key shown in the menu. Function keys described as 'F1' to 'F10' are those keys at the top of the keyboard and labelled as such, you should not press F followed by numbers.

An underscored red character on the screen indicates that pressing this key will begin a function. In most cases, beginning a function will put a GREEN highlight on the screen and the function can be exited without changing any settings by simply pressing ***Esc***. Whenever a GREEN function highlight is on the screen, pressing ***F1*** (HELP), will give assistance with that particular function.

The 'current command' is the command (HOLE etc.) which has been reached by using the Single Step and Back Step controls, is shown on the TV screen and whose Tool number and Command are shown on the Reference display line.

General help is available at the basic screen level to remind you of the available functions.


MICROMAT 1575 CONTROL SYSTEM - PROGRAM MODE
HELP F1
FILES F2
STROKE F3
HOME F4
RESET F5
RUN F6
HOLD F7
CHECK F8
EXPAND F9
MOVE F10
S STEP >
B STEP <
EXIT ESC
W clear 22mm
W height 10mm
Incr X 2.54
Incr Y 2.54
SIL 1
Gap ( 2.54 )
X
Y
Tool
Command
Reference: 0.00 0.00
Absolute: 0.00 0.00 1 HOLE
INSERT OFF

# FUNCTIONS AND COMMANDS

Please refer to the Program screen illustration.

The list on the right of the screen contains the following functions:

**HELP - F1**
Press ***F1*** to display short help messages related to the screen or any GREEN highlighted function. Help is available for each screen and for any item which is highlighted GREEN. Press Enter or Esc to remove the help message from the screen.

**FILES - F2**
Pressing ***F2*** loads the Files screen to allow you to LOAD or SAVE a data file.
When you leave the Files screen you will return to Program.
See FILES SCREEN.

**STROKE - F3**
Each press of ***F3*** starts the spindle, waits for the spindle speed to wind up and then operates the drill head through one complete drill stroke to enable drill depth and feed rate to be checked.

**HOME - F4**
Pressing ***F4*** drives both axes of the machine to their HOME (datum zero) position and sets the ABSOLUTE X and Y position displays to zero. The REFERENCE displays will retain any offset information that may have been programmed. See X and Y.

**RESET - F5**
A RESET command sets the system to the FIRST command of the program and sends the machine to its HOME position. Both the ABSOLUTE and REFERENCE position displays are set to ZERO. Any offset information that may have been programmed is also set to Zero.

**RUN - F6**
Allows access to the RUN screen to drill or rout a board. See RUN SCREEN.
Pressing ***F6*** will show a GREEN highlight with the question RUN?
Pressing ***Esc*** will exit the function and return to Program
Press ***Enter*** to go to the RUN screen.

**HOLD - F7**
Pressing ***F7*** temporarily stops the movement of the Check function. A second press resumes movement.

**CHECK - F8**
***F8*** starts the Check function moves the TV camera through a drill program to show where the commands are positioned. This function is especially useful for viewing the results of a step-and-repeat program ( i.e. a program using RPT and/or OPEN and CLOSE bracket commands ). Each position will be held for a short time. HOLD, ***F7*** will temporarily stop movement - ***Esc*** will exit the function.

**EXPAND** -- F9

This function removes all REPEAT and OPEN and CLOSE commands from the program and converts it to individual holes or routing commands.
Pressing ***F9*** will show a GREEN highlight with the question EXPAND?
Pressing ***Esc*** will exit the function.
If ***C*** is pressed, then the system will calculate and display two numbers. The first is the number of commands in the Step-and-Repeat program, the second is the number of commands had the data been entered individually for each position and for drilling programs shows the total number of holes to be drilled. The program will NOT be converted
If ***Enter*** is pressed in response to the EXPAND? then all REPEAT and BRACKET commands will be removed from the program and it will be converted to individual holes or routing commands. The two numbers displayed after conversion correspond to the number of commands in the Step-and-Repeat program and the actual number of commands in the new, expanded program.

**MOVE** - F10

This function moves the current command to a new location. All subsequent commands will be moved by the same amount.
Pressing ***F10*** will show a GREEN highlight with the question MOVE?
Pressing ***Esc*** will exit the function.
Use Single Step or Back Step to view the earliest command to be moved. If this is the first command of the program then ALL the program will be repositioned.
Use the joystick and position the command at its new location.
Press ***Enter*** and the program will be moved.

**S-STEP** > (Single-Step)

Allows a program to be checked by advancing one set of coordinates at a time and moving the target to those coordinates. The X and Y position, Tool number and Command are displayed on screen.
The system will not Single Step past an END command.
The ***Right Arrow*** key moves to the **last** command in the program.

**B-STEP** < (Back-Step)

As for Single Step but each press steps backwards one command through the program.
When the start of the program is reached the bleeper will sound six times.
The ***Left Arrow*** key moves to the **first** command in the program.
Immediately after using either the Single-Step or the Back-Step function, the machine will be showing the "Current Command".
The Tool Number and Command are shown in the Reference display line and the actual coordinates are displayed in the Absolute window.

**EXIT** - Esc

The ***Esc*** key offers a return to the Menu screen. Press ***Enter*** to Exit to the MENU screen or ***Esc*** once again to cancel the command and return to Program.

**Incr X** and **Incr Y** (INCREMENT)

These functions are used in conjunction with the four Arrow Key buttons or the four INCR buttons located round the joystick. Each button will move the corresponding axis by a distance equal to the value displayed in the '**I**ncr X' or '**I**ncr Y' window. A single press will move the target in the corresponding direction. If, after the move, the button is held down until a bleep is heard, the new coordinates, together with the current Tool number and Command will be entered into memory. If the button is still held down, after another short delay, the target will continue to move in the same increments and each position will be entered into memory until the control is released. A row of commands can be entered along the machine's axes.
Pressing ***I*** will show a GREEN highlight in the Incr display
Pressing ***Esc*** will exit the function.
Pressing the ***Up*** and ***Down*** arrow keys will change the increment value through 9 different pre-programmed, useful values and one user programmable value.
Press ***Enter*** to accept the selected value.

To set the user programmable value the required value must first be shown in the X or Y Reference window See **Reference** below.
Press ***I*** to show a GREEN highlight in the Incr display then press ***X*** or ***Y*** and the Reference value for X or Y will be transferred to the relevant Incr display.
Then press ***Enter***. The user programmable value is now selectable along with all the other values which can be accessed by using the ***Up*** and ***Down*** arrow keys as above.
The programmed value will be saved and restored the next time the system is switched on.

**SIL** (SINGLE-IN-LINE)

This function is used to simplify the programming of rows of holes (or any other command) where a row is required on a constant pitch. The spacing can be any value since the operator fixes the extreme positions of the row and sets the number of positions in the row.
Program the first position of a row, then, using the joystick and/or Incr buttons, move the target to the last position and press **S**.
Pressing **S** will show a GREEN highlight with the question SIL?
Pressing ***Esc*** will exit the function.
The total number of positions in the row will be highlighted.
This number is based on the dimension shown as **Gap**, Press ***Enter*** to accept the number or use the ***Up*** and ***Down*** arrow keys to change the value and then press ***Enter***.
The target will move to each position and the row will be entered into the program as individual commands.

If the spacing is not known ( i.e. not 2.54mm ):=
Program the first position in the row, move the target to the second position and press **G**. Then move to the last position and press **S** and continue as above.

**W** ( Workheight )

Pressing ***W*** allows changes in the Spindle Workheight reference position.
Use the ***Up*** and ***Down*** arrow keys to change the Workheight reference position.
Hold down the ***Shift*** key and the ***Up*** and ***Down*** arrow keys will **position** the Z axis at the Workheight reference position.
Press ***Enter*** or ***Esc*** to save the new value.

The Workheight reference position is the distance above the lower Z axis limit at which the Z feed rate becomes controllable by the settings on the Run screen.
The total Z axis movement is the sum of the Workheight reference position and the Clearance above this point.

**INSERT**

Pressing ***Ins*** will alternately toggle the Insert mode On or Off. When Insert is ON, entered commands will be inserted into the program immediately before the current command which was reached by using Single Step and Back Step and was indicated by the target position. When Insert is OFF, freshly entered commands will overwrite any existing data.

**DELETE**

A single press will delete the current command from the program. After the delete, the TV target will move to the next command in the program. If you make a mistake and wish to restore the command, press

**O** (oops!)

The last command you deleted will be recovered. This only works for the very last delete! Delete twice and you can only restore the last one. If you don't want to delete, don't press the button!

Below the TV picture are two windows marked Reference and Absolute.

**REFERENCE**

The Reference display line shows X and Y coordinates and Tool number and Command information.

The Tool and Command part of the display line shows the Tool number and Command of each position when Single Step and Back Step are used. When a Tool number and Command are displayed they are those of the Current Command. The Tool number and Command are also displayed for a short time whenever a command is entered with the Spacebar.

The Reference display X and Y coordinates can be set to Zero, or any other number, at any position on the table. This can be used to provide a reference point for the transfer of information from drawings. It is a reference only, the programmed coordinates are always those shown in the Absolute display.

To change the X or Y Reference display ( the X and Y are underlined )
Press X or Y to show a GREEN highlight on the X or Y Reference display
Press ***Esc*** to exit the function and leave the X or Y Reference display as it was.
Press ***Enter*** and the display will be set to Zero
or
Use ***Up*** and ***Down*** arrow keys to change the numbers to the right of the decimal point
Use ***Left*** and ***Right*** arrow keys to change the numbers to the left of the point.
Press ***Enter*** to accept the number

**ABSOLUTE**

The Absolute display shows

a/ The X and Y coordinates with reference to HOME ( machine zero )
b/ The active Tool number
c/ The active Command

This information is entered into the program memory by pressing the Spacebar

a/ The X and Y coordinates are changed whenever the Joystick and/or the Incr buttons are used to move the TV Target.

b/ The active Tool number is set by pressing **T**
( note that the T in Tool is underlined )
The active Tool number will have a GREEN highlight.
Use the ***Up*** and ***Down*** arrow keys to select the required Tool number from 0 to 15
Press ***Enter*** to accept the Tool selection.

c/ The active Command is set by pressing **C**
( note that the C in Command is underlined )
The Active Command will have a GREEN highlight.
Use the ***Up*** and ***Down*** arrow keys to select the Active Command from :-
**HOLE, DOWN, CTR CW, CTR CCW, UP, POCKET, REPEAT, OPEN, CLOSE**
Press ***Enter*** to accept the Command selection.

A quicker method to set the Active Command is:

Press **H** to set **HOLE,**
Press **D** to set **DOWN**
Press **[** to set **CTR CW**
Press **]** to set **CTR CCW**
Press **U** to set **UP**
Press **P** to set **POCKET**
Press **R** to set **REPEAT**
Press **(** to set **OPEN**
Press **)** to set **CLOSE**

**JOYSTICK**

This is used to move the TV target to the position on the circuit board to be drilled or routed. It should always be used to move away from any YELLOW bars at the side of the TV Picture to avoid driving the table to any of it's limit positions. YELLOW bars indicate that the table is within 6mm of its limits, a RED bar indicates limit. If the table is driven into its limit then all motion will stop and HOME must be pressed to enable further movement.

**Shift/T** ( TV Target - Position, Size and Colour)

Pressing ***Shift/T*** allows changes to the position, size and colour of the TV Target.
Press ***Shift/T*** to show a GREEN highlight Picture Position
***Esc*** will cancel the function.

Use the ***arrow*** keys to change the POSITION of the target.
Press ***C*** to set the target to it's central position..

Use the ***Plus*** and ***Minus*** keys to change the SIZE of the target.
Press ***S*** to set standard default target size.

Use the ***0*** to ***9*** number keys to change the COLOUR of the target.
Press ***G*** to change the target between large and small graphic blocks.
Press ***Enter*** to accept the selections.

**F** ( Set Focus height of the TV Camera )
**MM300/MM500 machines only**
On all other Micromat machines the camera focus is adjusted by raising and lowering the camera manually.

Press ***F*** to change the Focus height of the camera.
Use the ***Up*** and ***Down*** arrow keys to change the Focus position.
Press ***Enter*** to save the new Focus position or ***Esc*** to exit without saving.

## XY FLIP and SWAP functions

**ALT/X** flips the program centrally about it's X axis

**ALT/Y** flips the program centrally about it's Y axis

**ALT/Z** flips the program in both it's X and Y axis

### ALT/R - RESIZE FUNCTION

Press **ALT/R** to resize and/or rotate a program around it's **first** command position.
Help is available through **F1**
Use the Arrow keys to set the Rotation angle under the Y axis display up to a maximum of 180 degrees (+ve = clockwise)
Press **S** to set the Size multiplier under the X axis display. Use the arrow keys to change the setting.
Press **R** to set the Rotation angle under the Y axis display
Press **Enter** to make the changes and exit the function.
Press **Esc** to exit the function and leave the program unchanged.

### ALT/V - AUTO-RESIZE FUNCTION

Place filmwork or board to be drilled on machine bed.
Ensure the first command is aligned with the camera system.
Move the camera to a known position as far away as possible from the first command position and press SST to locate that position and it's co-ordinates in the program.
Move the camera to the correct position for the command and press **ALT/V**
The program will be resized and rotated to align perfectly with the

**ALT/G - GRAPHICS FUNCTIONS**

Press **ALT/G** to change the area of the TV display to provide a graphic display of the drill or rout program overlayed on the bed of the machine. Help is available through **F1**

The Active Tool number will be shown in Yellow and this can be altered by pressing T followed by the up and down arrow keys to change the number. The rest of the drill or rout program will be shown in White with the first command position shown thicker that the rest of the data. SST, BST and CheckRun functions also operate in this mode and show the current program position displayed by a large crosswire.

**Editing**

The arrow keys will move the total pattern around the bed of the machine by the amount selected in the Incr window. (Press Shift for Incr x 10)

The + and – keys will enlarge or shrink the total pattern around the first command position in 0.01% steps (press Shift for 0.1%)

The [ and ] keys will rotate the total pattern around the first command position in one degree increments. (press Shift for 10 degrees)

Press **ALT/G** to return to the TV picture or press **ALT/R** for more precise Shrink and Rotate settings.

Remember that **ALT/L** will always restore the last saved backup.

Another great Micromat plus.

## PROGRAM BACKUP

Working drill and rout programs are saved on floppy disks in the Files screen or can be transferred to another system via the network connection. However, we strongly recommend that you use floppy disks and keep just one job on each disk to avoid confusion over the correct file to be used.
Disks are not expensive and can easily be copied for safety. More importantly, they can be kept in a file with the rest of the paperwork for each job so you can find them when you need them.
There are many hi-tech solutions for downloading data from here, there and everywhere. These solutions can *probably* be made to work in a *hi-tech* environment with *hi-tech* equipment and *hi-tech* staff on *hi-tech* salaries . . . . . so just use floppy disks.
The Micromat has another program backup system and its use is intended to solve the problems of power failures and other inadvertent shut downs which may cause loss of data. The backup process is mostly transparent to the operator in that the data is transferred to the controller's hard drive whenever a program is loaded from disk or a job is programmed manually.
In the case of manual program entry, the system will make a backup whenever an END command is programmed by pressing the ***E*** key. It will also make a backup every time the system moves from one screen to another. A backup can be also made whenever you may feel it necessary by simply pressing ***Shift/B***
i.e. holding down the ***Shift*** key and pressing the ***B*** key.
e.g. whenever you go for a break from entering a program, lunch, etc. etc.
The backup program can be loaded by pressing ***Shift/L***

## AUTOMATIC RESTORE

With this backup system, each time the machine is switched on it will have in it's memory, restored from hard disk, the last program that was being used, whether you saved it to floppy disk or not.

# PROGRAM COMMANDS EXPLAINED

## SPACEBAR

The ***Spacebar*** is the main program data entry key. Each time the Spacebar is pressed, the information in the **Absolute** display line, that is the **XY coordinates**, the **Active Tool number** and the **Active Command**, will be entered into the program memory. A bleep indicates that data has been entered.
Commands can be any one of:-
HOLE, DOWN, CTR CW, CTR CCW, POCKET, UP, REPEAT, OPEN, CLOSE and their operation is as described below. They can be set by pressing C and making the selection using the up and down arrow keys or be set directly by pressing **H, D, [, ], P, U, R, (,** and **)** respectively.
Note that the coordinates and the Tool number are entered automatically with each command.
All program data except the END command is entered using the Spacebar To enter an END command simply press the ***E*** key and a single END command will be added to the program data.

## HOLE

Each position programmed as a HOLE will be drilled using the Tool programmed with the command.

## DOWN

This command controls the position at which the routing cutter is to be fed into the circuit board.

If followed immediately by an UP command, the cutter will be fed into the board and then withdrawn, making a single hole the same diameter as the cutter.

If followed by further DOWN commands, with different coordinates, the machine will cut in straight lines between each pair of DOWN coordinates.

DOWN may therefore be regarded as a "down and stay down" command until an UP is programmed.

Arcs can be programmed by using the DOWN command to enter three points around the arc. The cutter will trace an arc through all three points starting with the first point, moving through the second point and finishing at the third point.

A three point arc is programmed by entering a Double Down command at the first point to indicate the start of an arc, ( i.e. press the Spacebar TWICE ), followed by single DOWN command near to the centre of the arc and a final DOWN at the end of the arc.

The arc will prove to be more accurate if the second point is chosen somewhere close to the mid point of the arc. There is no limit to the size of the arc.
If the third point is programmed as a Double Down command, a second arc can be joined to the first. This process can be continued to produce a series of consecutive arcs.

**CTR CW** (Centre Clockwise)
**CTR CCW** (Centre Counterclockwise)

The CTR CW (Centre Clockwise) and CTR CCW (Centre Counterclockwise) commands are used to program the centre point of circles or part circles.

The command to be used depends upon the required direction of the cutter as it moves round the circle or arc.
e.g. To program the machine to cut a full, or part, circle a total of four commands are required:-
1) a DOWN command at the start point of the circle.
2) a CTRCW or CTRCCW command at the centre.
3) a second DOWN command at the point at which the circular cut is to finish ( the same point as the first DOWN command for a complete circle ).
4) an UP command to withdraw the cutter from the board at the end of the cut.

**POCKET**

The POCKET command is used to identify the corners of a straight edged pocket or the diameter of a round or annular pocket to be routed.

To program a straight edged pocket.
1) Program a DOWN command at the first corner.
2) Program a POCKET command at each corner point moving the same way around the pocket.
An UP command is not required. All corner points must be in full view of the center point of the pocket.

To program a circular pocket.
1) Program two CTR commands at the center of the pocket.
2) Program a third CTR at the center point.
3) Program a POCKET command at any point on the circumference of the pocket.
An UP command is not required.

To program an annular pocket.
1) Program two CTR commands at the center of the pocket.
2) Program a third CTR at any point on the inner circumference of the pocket .
3) Program a POCKET command at any point on the outer circumference of the pocket.
An UP command is not required.

**UP**

The UP command is used to enter the position for the cutter to withdraw from the board at the end of a straight line cut. The coordinate information entered with the UP command is irrelevant since the command is used only to lift the cutter, however, the setting of the TOOL number IS important, since UP commands are used in conjunction with previously entered DOWN commands using the same TOOL number.

NOTE:- DOWN and UP and DOWN and CTR commands for the same cut must be programmed with the same TOOL number.

**REPEAT**

Allows a pattern of drilling or routing information to be repeated as often as required on one panel thereby reducing overall programming time. This function should only be used when multiple circuits are to be produced on one panel of laminate. The Tool number for this command is automatically entered as zero.

**OPEN** ( BRACKET )
**CLOSE** ( BRACKET )

These commands allow operator specified patterns (e.g. for DIL packages) to be repeated within a program. As many different patterns as required may be entered provided they are each contained within their own set of BRACKETS. OPEN BRACKET commands specify the start positions of the pattern and must be followed by the pattern itself, then a single CLOSE BRACKET command. The Tool number for
these commands is automatically entered as zero.

**END**

This command MUST be entered at the end of a program to signify that no further instructions are entered. If omitted, the Micromat will continue past any programmed information and pull from its memory any previously entered data, which may destroy the pattern, which has already been drilled. The Tool number for this command is automatically entered as zero. Only one END command is needed in a program. Do not put END commands after each Tool size.
To program and END command, simply press the ***E*** key.
Whenever an END command is programmed, the system will make a safety backup of the program in non-volatile memory.
A backup can be made at any other time by simply pressing ***Shift*** and the ***B*** key.
The backup data can be re loaded into memory by pressing ***Shift*** and the ***L*** key.
The memory capacity of the Micromat will store 500,000 individual commands.

# ROUTING NOTES

The cutting speed for routing is programmed at the Run screen and is calibrated in Millimetres/min.

An allowance must be made for the cutter diameter in all routing programs.

The INCR function can be used for cutter offset if a value of half the cutter diameter is selected but will, of course, only be fully effective if used parallel to the axes of the machine.

For best results with the 125 watt spindle, use a 1.6 mm dia. routing cutter with a maximum stack height of 3.2 mm. Up to 2.4 mm dia and a circuit board stack height of 4.8 mm may be used with the 450 watt spindle.

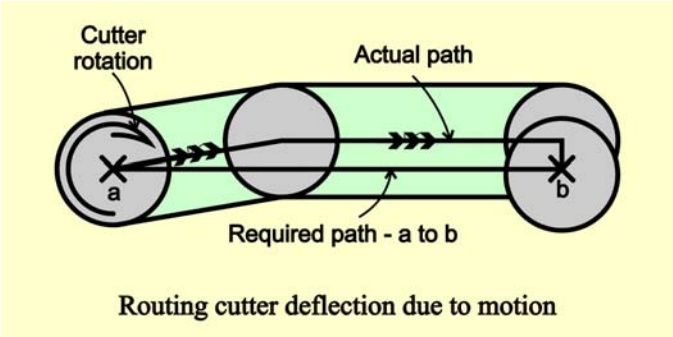
Use a very slow feed rate (250 - 400) to plunge the cutter into the board (use only plunge end cutters) and a spindle speed of between 35,000 and 45,000 rpm. for the 125 watt spindles.
Use 30,000 to 40,000 rpm for the 450 watt spindles.

If a high pitched whine is heard then try reducing the cutter rpm, or increasing the cutting rate.

For smaller cutters, e.g. 1 mm and under, use a higher spindle speed (55,000) and slower cutting rate.

It must also be understood that while routing is taking place there is **always** an appreciable deflection of the routing cutter. This is caused by the cutter bending under the load of routing where only the forward edge of the cutter is in contact with the laminate.

The deflection will vary depending upon the size of the cutter and the linear cutting speed and could be as much as 0.15mm (0.006") and will cause the bottom board in a stack of three boards to be cut larger than the top board.



Routing cutter deflection due to motion

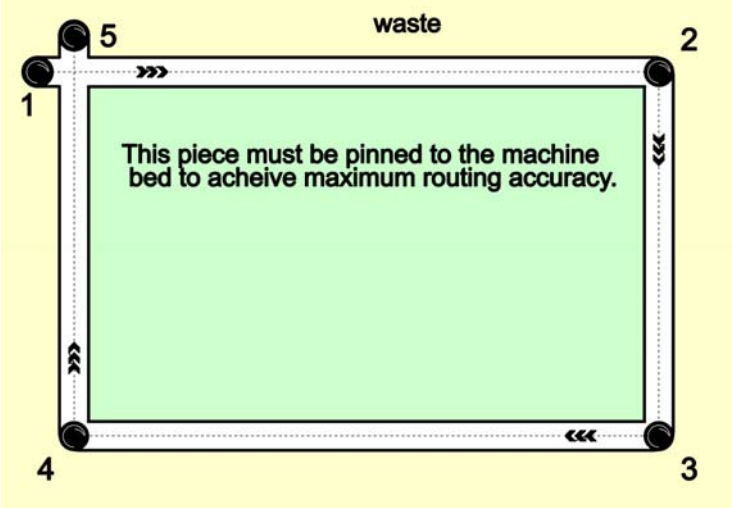
If greater accuracy is required, then the part should be routed in two passes. The second pass will be cutting only a small amount of laminate and the cutter deflection will therefore be negligible.

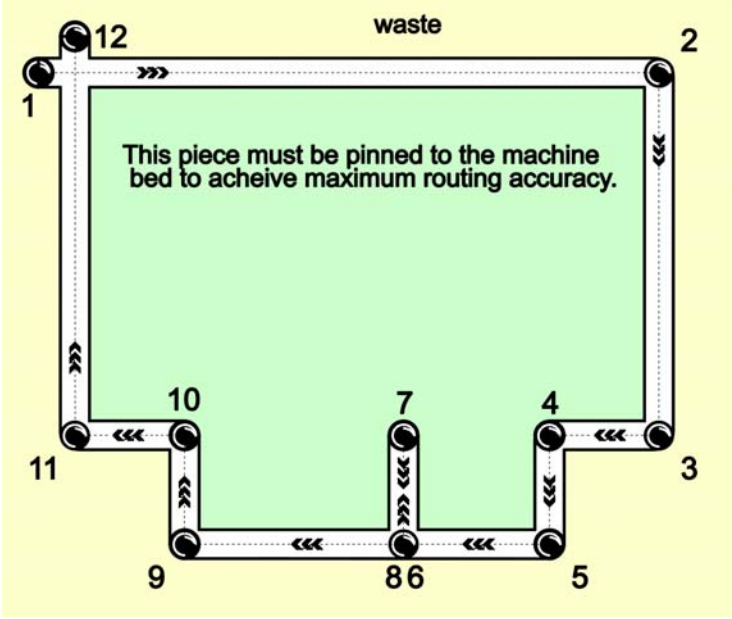
Any measurement of routed parts should be conducted with great caution as changes in temperature can greatly change the size of a piece of laminate.

**LINEAR ROUTING EXAMPLES**

| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | DOWN |
| 3 | DOWN |
| 4 | DOWN |
| 5 | DOWN |
| 5 | UP |
| 5 | END |

Note that there are three commands at position 5.




Positions 1 to 11 are programmed sequentially with DOWN commands entered at each point.

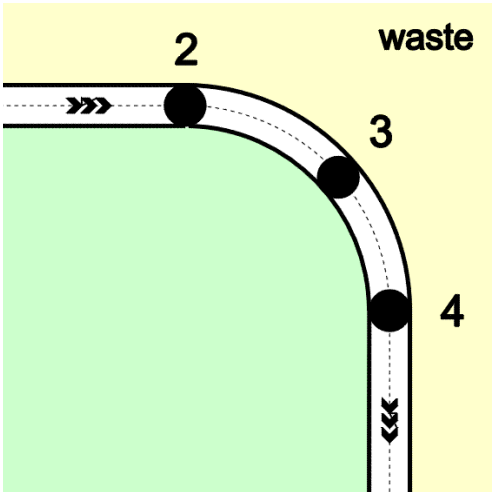
Position 12 is then programmed with 3 commands, all in the same place:-
DOWN, UP and END.

Note that in this example points 6 and 8 are in the same position.

# CIRCULAR ROUTING EXAMPLES

## ARCS using DOUBLE DOWN COMMANDS

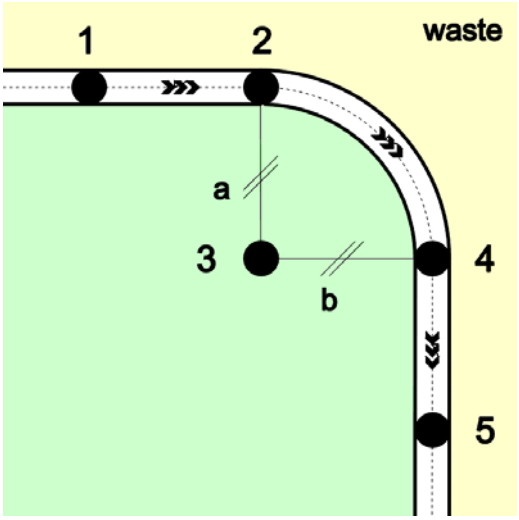
| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | DOWN + DOWN |
| 3 | DOWN |
| 4 | DOWN |
| 5 | DOWN |




Position 2 has two DOWN commands in exactly the same place.
Simply press the Spacebar twice. This technique can be used for cutting arcs from 0.5 to 359.5 degrees in either direction; the Double Down indicates the start of the arc.

## ARCS using DOWN-CENTRE-DOWN COMMANDS

| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | DOWN |
| 3 | CTR CW |
| 4 | DOWN |
| 5 | DOWN |

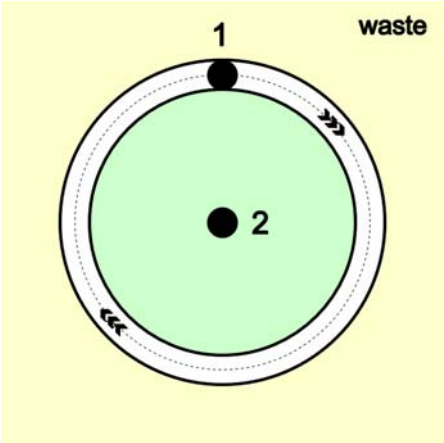



Position 3 needs only to be approximate, the system will recalculate it's position to keep both 'a' and 'b' equal in length.

## OUTSIDE CIRCLE

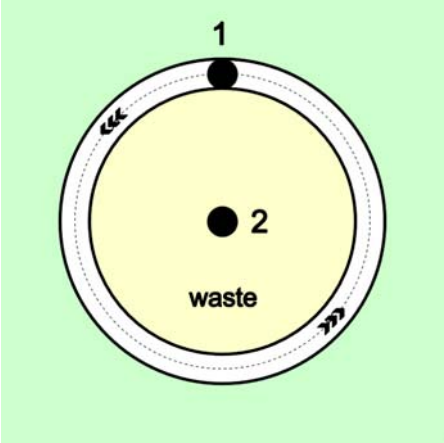
| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | CTRCW |
| 1 | DOWN |
| 1 | UP |

Position 1 is programmed with a DOWN command, position 2 with a CTRCW command and then position 1 again with a DOWN and an UP command at the same position.




## INSIDE CIRCLE

As above but position 2
is programmed with CTR CCW

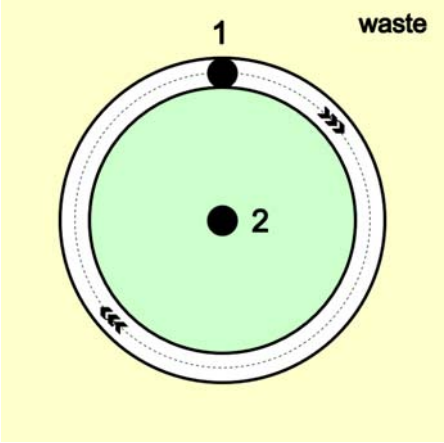



## SIMPLE CIRCLES

### Outside Circles

| Position | Command |
|---|---|
| 1 | CTRCW |
| 2 | CTRCW |

An separate UP command is not required.
It is included with the second CTR




### Inside Circles

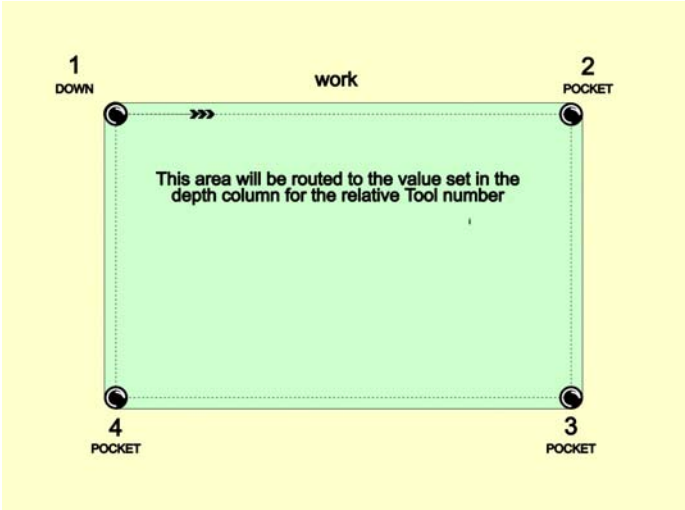
Two CTRCCW commands should be used for inside circles

# POCKET ROUTING

## RECTANGLAR POCKETS

| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | POCKET |
| 3 | POCKET |
| 4 | POCKET |

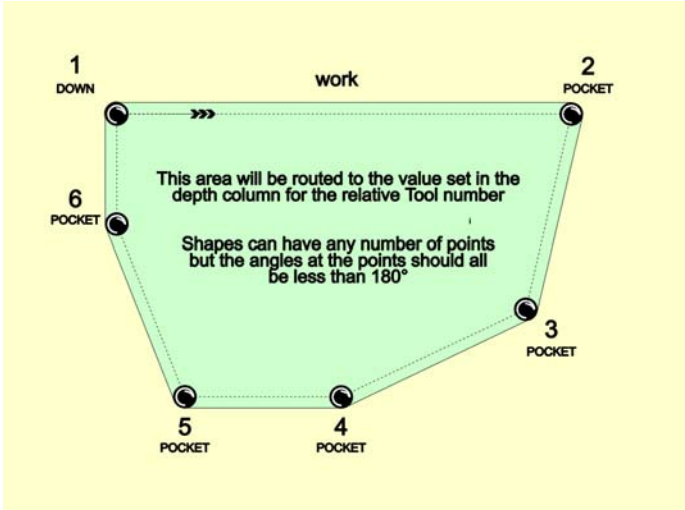
A separate UP command is not required.



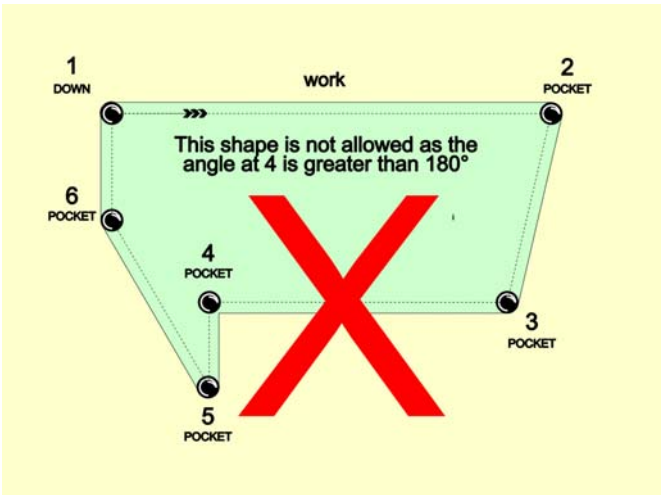

## MULTI SIDED POCKETS

| Position | Command |
|---|---|
| 1 | DOWN |
| 2 | POCKET |
| 3 | POCKET |
| 4 | POCKET |
| 5 | POCKET |
| 6 | POCKET |

A separate UP command is not required

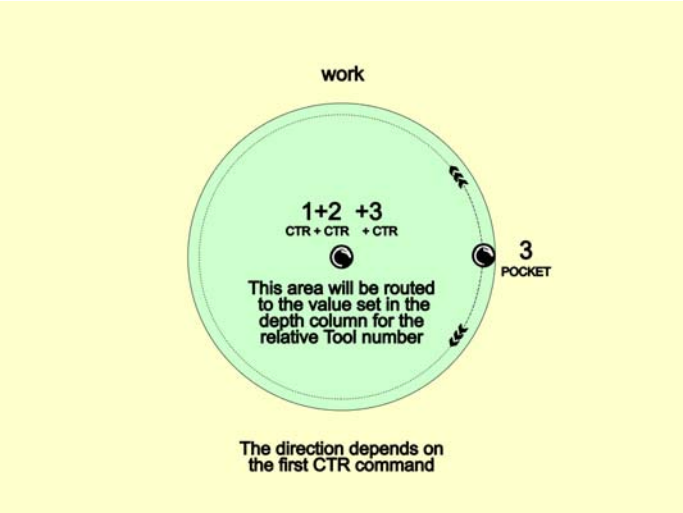



**The center of the shape must be visible from every corner**



## CIRCULAR POCKETS

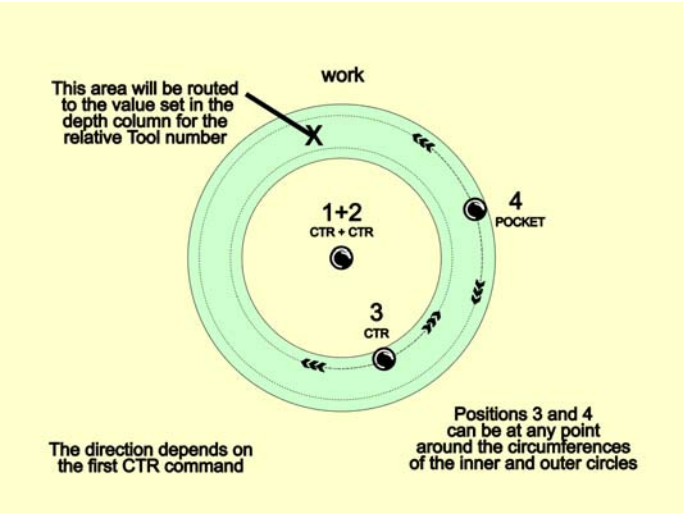
| Position | Command |
|---|---|
| 1 | CTR |
| 2 | CTR |
| 3 | CTR |
| 4 | POCKET |


work
1+2 +3
CTR + CTR + CTR
3
POCKET
This area will be routed to the value set in the depth column for the relative Tool number
The direction depends on the first CTR command

The pocket is routed between the third CTR command and the POCKET command. The direction of the first CTR command determines the direction of the cut.

## ANNULAR POCKETS

| Position | Command |
|---|---|
| 1 | CTR |
| 2 | CTR |
| 3 | CTR |
| 4 | POCKET |


work
This area will be routed to the value set in the depth column for the relative Tool number
1+2
CTR + CTR
4
POCKET
3
CTR
The direction depends on the first CTR command
Positions 3 and 4 can be at any point around the circumferences of the inner and outer circles

The pocket is routed between the third CTR command and the POCKET command. The direction of the first CTR command determines the direction of the cut

# Z AXIS CONTROLS

DRILL STROKE and DEPTH (Set on RUN screen)

The working stroke of the Z axis is defined as that distance set in the DEPTH field of the Run screen and measured below the Workheight position, which is set using W on the Prog or Run screen.

For each Tool number the Run screen has fields to control the ROUTing speed (linear travel speed) of the X and Y axes and the SPEED (RPM) of the spindle and there are added fields to control the IN-FEED of the Z axis in millimetres per minute, the CLEARance of the tool above the set Workheight position, the DEPTH of a stroke below the Workheight position, and whether the stroke is completed in one pass or in a series of PECKing movements.

Linear travel speed is set in the ROUT field. Range: 200 to 1600 millimetres per minute.
The spindle RPM is set in the SPEED field. If the spindle speed is set to 0 (zero) for a particular tool number then any commands programmed on that tool number would not be performed. Normal range: 20 – 60 ( x 1000 RPM )

The FEED parameter controls the in-feed speed over the working stroke. Range: 250 - 4000 millimetres per minute. Travel between the Workheight and the Clear position and the Clear position and the top of the stroke are at high speed.

The clearance distance to allow for movement over the surface of the work is set in the CLEAR field of the Run screen. For a given job the clearance distance should be the same for all tools. 0.5mm is a reasonable setting. Settings are in steps of 0.01mm.

The depth of the cut for each tool is set in the DEPTH field. The maximum value depends on the setting of the Reference position relative to the total travel available and would not normally be greater than 10mm. Settings are in steps of 0.01mm

The number set in the PECK field controls how many pecks the Z axis will make to complete it's working stroke. The maximum setting is 99 pecks.
If the GREEN highlight has been moved to Tool 0 when ***F6*** is pressed ALL the commands in the program will be performed in Tool Number order providing the RPM for a Tool Number is not set to 0.

If the GREEN highlight has been moved to any other existing tool number when ***F6*** is pressed, then ONLY the commands programmed with that tool number will be performed.

Rout, Speed, Feed, Clear, Depth and Peck can all be changed while a program is running or by pessing HOLD (*F7*), changing the settings and pressing *F7* again.

When **not** running, pressing ***Shift M*** on the Run screen will set all fields for all tool numbers to a mid range set of values. This ensures at least a set of viable numbers as a starting point when entering a new program.
The Run parameters will be saved to disk along with the actual program data.

When **running** pressing the Right Arrow key will move the green highlight across the Run screen fields where minor changes can be made without stopping the machine.

**Z axis Workheight reference setting**

The Workheight point is set using ***W*** on the **PROG** or **RUN** screens. The position of the Workheight  is the number of millimetres above the bottom of the stroke.

Remember that you cannot set the DEPTH on the Run screen to be any greater that the Workheight value.

The total Z axis stroke available is the sum of the Height and Clear values shown on the **PROG** and **RUN** screens.

**Z axis stroke calibration**

The total Z axis stroke is calibrated using the Cal Z function on the Utils 2 screen

This calibration procedure should not be required unless the Z axis assembly has been has been changed or altered in any way (e.g. service)

# DRILL CHANGE AND DEPTH SETTING

MANUAL TOOL CHANGE SPINDLES TYPE 4025, 4026, 4032 AND 4040.

In PROG mode

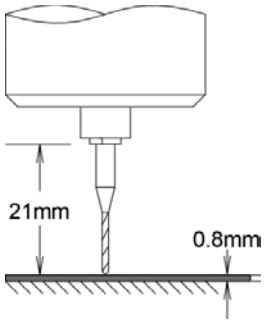
1) Drive the head of the machine to position the pressure foot over the table.
2) Press Shift D to drive the Z axis to it's lowest position.
3) Adjust the pressure foot to the level of the table by loosening the collars on the top of the pressure foot rods and allowing the springs to force the pressure foot down to the table.

Retighten the pressure foot collars.

4) Press Shift D to raise the Z axis
5) Position a piece of 0.8 mm laminate under the pressure foot.
6) Press Shift D again
7) Fit the required size drill into the spindle collet with approximately 21 mm protruding.
8) Replace the spindle in the head and gently slide down until the drill tip is just touching the 0.8 mm laminate.
9) Tighten the spindle retaining lever and reconnect the spindle connector.
10) Press Shift D once more to raise the Z axis.

The drill fully down position obtained by using Shift D (HEAD DOWN) is now set to 0.8 mm above the bed of the machine and a backup material of greater than 1.6 mm should be used to ensure that the drill will pass completely through the circuit board.

For large diameter drills (above 2 mm) the backup material thickness should be increased unless the drills have flat tips.



**Z axis Depth Setting - Machine in PROG mode**

**a)**
**To drill thin material fixed to the bed of the machine. E.g. Printed Circuit Board**

Set the Workheight to at least 1mm greater than the thickness of the material being drilled.
e.g. 8mm for 3 pieces of 1.6mm laminate and 1 piece 1.6mm backup material (4 x 1.6 = 6.4)

On the RUN screen, set the Depth to 8mm.

1/ Remove spindle
2/ Fit tool with 21mm protruding from collet.
3/ Position pressure foot over machine table with joystick.
4/ Press **Shift - D** and Z axis will drive down to its lowest position.
5/ Adjust pressure foot to rest on table surface.
6/ Press **Shift - D** to lift head to up position.
7/ Place a piece of 0.8 mm material under the pressure foot.
8/ Press **Shift - D** and Z axis will drive down to its lowest position.
9/ Refit spindle with tip of tool touching top of the 0.8mm material.
10/ Tighten spindle clamp and reconnect spindle cable.
11/ Press **Shift - D** to lift head to up position.

**b)**
**To drill or mill a particular depth into the workpiece.**

Set the Workheight to a number greater than the deepest hole to be drilled or milled.

1/ Remove spindle
2/ Fit tool with 21mm protruding from collet.
3/ Position pressure foot over work surface with joystick.
4/ Press **Shift - R** and Z axis will drive down to Reference position.
5/ Adjust pressure foot to rest on work surface.
6/ Refit spindle with tip of tool touching work surface.
7/ Press **Shift - R** to lift head to up position.

On the RUN screen,
**Clear** sets the position of the head during its travel between holes.
e.g. a setting of 3 means the tip of the tool will be 3mm above the work when traveling between holes.
The **Depth** setting sets the depth of the hole below the Workheight for each Tool Number.

# TV TARGET ALIGNMENT

Operation test

1) Go to the Program screen and allow the machine to travel to its HOME position.

2) Fix a piece of 1.6mm material to the drilling bed.

3) Press ***F5*** (RESET) to set the Active Tool Number to ***1*** and the Active Command to ***HOLE***. (Default)

4) Using the joystick, position the TV target over the laminate and enter six holes by holding down one of the ***INCR*** buttons for six bleeps, ensuring that the target is still over the laminate and then press ***E*** enter an END command.

5) Press ***F5*** (RESET) to set the system to the first command.

6) Set the drill depth with a drill diameter of approximately 1.5mm

7) Press ***F6*** and ***Enter*** to go to the RUN screen

8) Set feeds and speeds to useable values. Or use ***Shift M***

9) Press ***F6*** to drill the six holes

10) Press ***Esc*** then ***P*** to return to the Program screen

11) Use ***SST*** and ***BST*** to look at the holes and adjust the target position by using the two controls on the top of the camera.
On later machines press ***Shift/T*** and use the ***arrow*** keys to adjust the target position.

12) Target size and colour may also be adjusted. Press ***F1*** for details

13) Press ***Enter*** when finished

# MM300/500 TV TARGET ALIGNMENT

This procedure is only required for the MM300/500 machines and should not normally be required unless the camera has been removed and replaced.

The process ensures that the TV target position is calibrated in relation to the drill.

Use a drill of at least 1.5mm diameter.
Ensure that the drill depth has been set 0.8mm above the bed of the machine
Fix a piece of relatively soft 1.6mm material to the bed of the machine.

In PROG mode

1) Press ***Shift/T*** and then ***C*** to place the target in its central position.

2) Press ***Enter***.

3) Use the ***joystick*** and position the DRILL over the material.

4) Press ***Shift and F3*** to drill a hole at that position.

5) Press the @ key to zero the Reference coordinates.

6) Use the joystick to align the target with the drilled hole.

7) Press ***Shift/T*** then ***F*** use the ***Up*** and ***Down*** arrow keys to focus then press Enter twice.

8) Both the X any Y Reference coordinates must be negative when the hole is aligned.

9) When the target is aligned with the hole Press ***Shift A*** and answer Yes to store the camera offset.

After this procedure the machine must be taught its table size as follows.

Press Esc and Enter to confirm Exit to the Main Menu
Hold down ***Ctrl***, ***Alt*** and ***Shift*** keys and press ***1***
The Operating Parameter Setup screen will be shown
Press the Tab key to highlight “X & Y Limits” and press Enter

The machine will measure its table limit positions relative to the stored camera offset positions and save the results as defaults.

Press ***Esc*** to return to the Main Menu

# TOOL CHANGE AND DEPTH SETTING
# AUTO TOOL CHANGE SPINDLES

Tools are stored in 15 tool pods located beneath the drill bed. Two extra pods are provided and labeled “K” and “D”

The following functions are available to allow the correct setting of drill bits for the auto tool change system. They can be operated from both the PROG and RUN screens.

## INITIALISE

***Shift-I*** then **Yes** to confirm ***Esc*** will exit and lower the pods

This function is used to place whatever tool is in the collet into the DUMP pod and to replace that tool with whatever tool has been placed in the K pod. The function will automatically be followed by the LOAD function to allow tools in the Dump pods to be removed.

## LOAD

***Shift-L*** then **Yes** to confirm ***Esc*** will exit and lower the pods

The LOAD function is used to raise and lower the tool pods to allow fitting and removing drill bits. When the pods are retracted they are protected from damage and an unrestricted drilling bed is presented to the operator making board loading and removal very simple.

LOAD will only operate after the machine has gone to its HOME position and the spindles are stopped.

## COLLET OPEN - CLOSE

***Shift-C*** then **Yes** to confirm ***Esc*** will exit and CLOSE the collets

This is a safety feature to disable opening the collets until the spindles have stopped rotating and the table is at its HOME position. The COLLET OPEN switches to the left of the drill bed will only operate while this function is active. ***Esc*** will exit and CLOSE the collets

Serious damage will result if the spindles are operated with the collets in the open position

The **DRILL PODS** are mounted under holes in the drill table and marked as follows:

| | | |
|---|---|---|
| 'D' | **DUMP** POD | ALWAYS KEEP THIS POD EMPTY. |
| 'K' | **KEEPER** POD | |
| '1' | **TOOL 1** POD | |
| '2' | **TOOL 2** POD | |
| '3' | **TOOL 3** POD | |
| '4' | **TOOL 4** POD | |
| etc. | up to a maximum of 15 pods. | |

The KEEPER is an important part of the system and its purpose is to maintain the accuracy of the drill spindle collet. Whenever the system is not in operation the keeper MUST be installed in the collet to prevent the collet from being damaged by closing too far. The collet is opened by air pressure and closed by a strong spring. If the collet is allowed to close while empty, it will be forced smaller than the size of the drill shank and will not open enough to allow the drill to be inserted.

When the MICROMAT is in operation in the Auto Tool Change mode, the KEEPER will automatically be placed in the POD marked 'K' and will be picked up again when drilling is completed, so normally no operator action will be required to ensure that the keeper is in place.

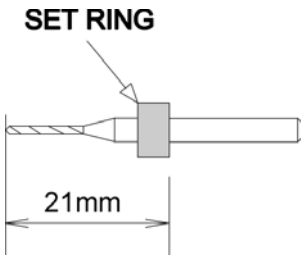
The KEEPER is to prevent the collets closing when the machine is not in use. A broken drill bit makes an ideal keeper. There must ALWAYS be a tool or a keeper in the collet to prevent collet distortion.

After an emergency stop it will be necessary to complete an Initialise function to ensure that the tools are in their correct pods

## SETTING THE SPINDLE POSITION

The spindle MUST be set to the correct height above the bed of the machine and this should be done whenever the spindle is replaced after cleaning the collet.

All drill bits must be fitted with a plastic SET RING positioned to give a working length of 21mm.




1) Fit the spindle into its mounting block a little higher than its normal position and temporarily tighten the clamping screws .

2) Use the COLLET OPEN switch to fit a drill bit of approximately 2.0mm diameter into the collet, ensuring that the SET RING is held firmly against the collet while the COLLET OPEN switch is released.

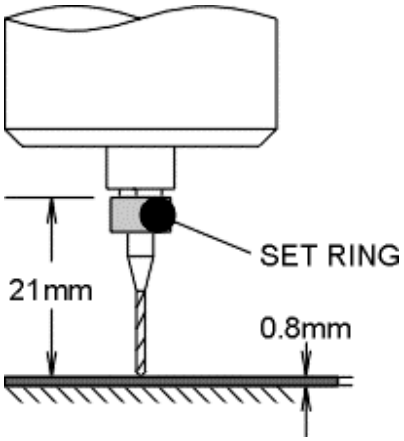
3) Position a piece of 0.8 mm (1/32") laminate under the pressure foot.

4) Press ***Shift-D*** to lower the drill head to its fully down position.

5) Loosen the spindle clamping screws and gently slide the spindle down until the drill tip is just touching the top of the 0.8 mm laminate.

6) Tighten the spindle clamping screws and repeat the process for any other spindles.

7) Press ***Shift-U*** to raise the drill head to its fully up position.




The operational FULLY DOWN position of the drill is now set to 0.8 mm above the bed of the machine and a backup material of greater than 1.6 mm should be used to ensure that the drill will pass completely through the circuit board. For large diameter drills (above 2 mm) the backup material thickness should be increased unless the drills have flat tips.

# LOADING TOOLS INTO THE PODS

1) Press F4 or F5 and wait for the machine to achieve it's HOME position.

2) Press ***Shift-L*** and confirm Yes. This will raise all the PODS above the drilling bed.

3) Ensure that the DUMP POD marked 'D' is EMPTY.

4) Fit a KEEPER (or broken drill bit) into the KEEPER POD marked 'K'.

5) Press Esc and the PODS will all retract.

6) Press ***Shift-I*** and confirm Yes (INITIALISE). The machine will place whatever tool is in the collet into the DUMP POD and pick up whatever is in the KEEPER POD, in this case a KEEPER (or broken drill), and then raise all the tool pods.

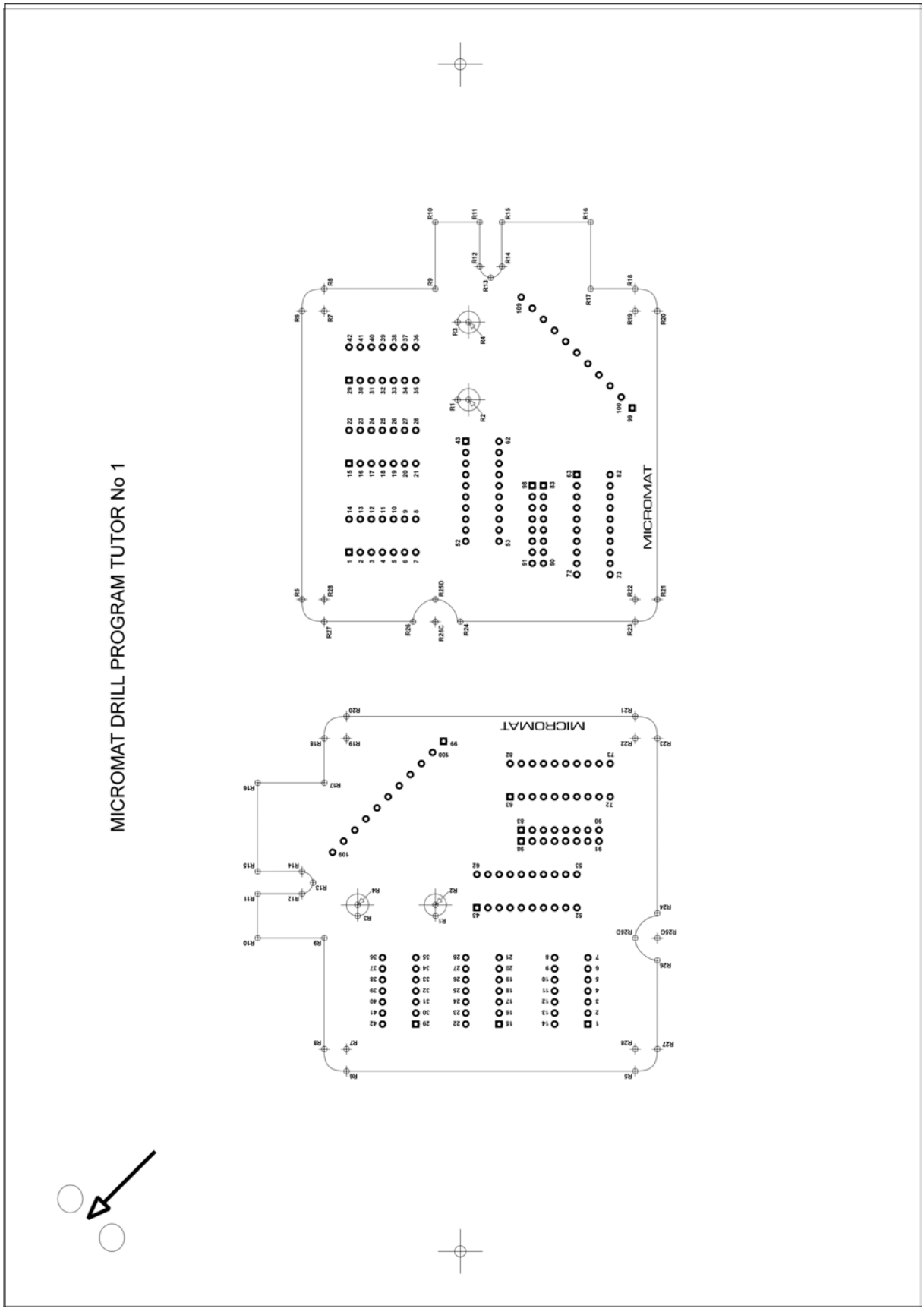
7) Remove the contents of the DUMP POD. **ALWAYS KEEP THE DUMP POD EMPTY.**

8) Fit the required size drill bits into their allocated PODS according to the tool numbers of the drill program and ensure that they are all firmly seated into their receptacles. Press **Esc** and the PODS will all retract to lower the tools beneath the drilling table.

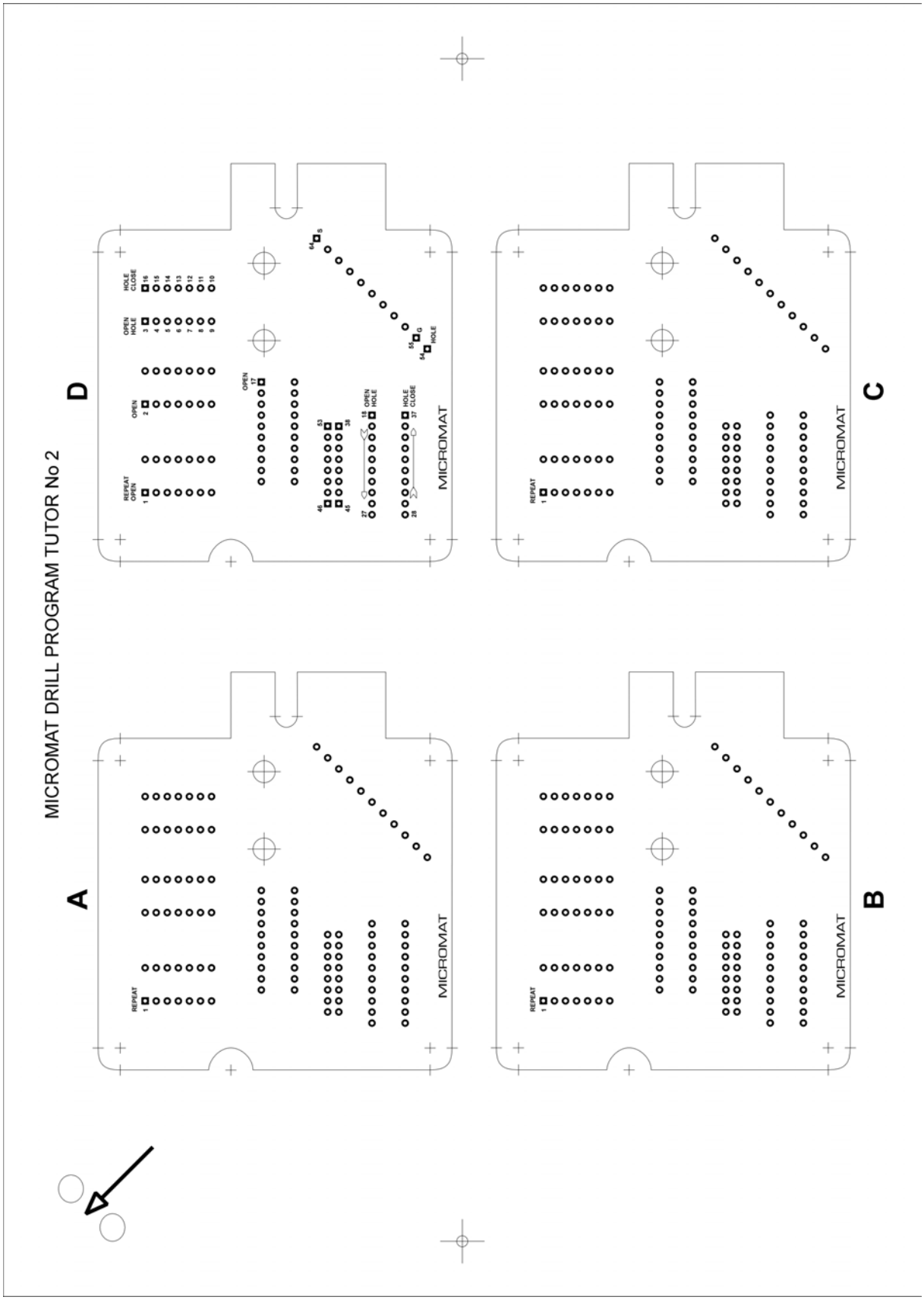
The spindle and pods are now fitted with known drill sizes in each pod and a known tool in the collet. If the drill program is allowed to finish normally, the tool which is in the collet at the beginning (KEEPER or broken bit) will be returned to the collet on completion

Actions 1 to 7 above (INITIALISE) may be used to load a particular size drill into the collet for manually operating the machine as described RUN AND THE TOOL NUMBER.

# PROGRAM TUTOR 1



# PROGRAM TUTOR 2



# HOW TO ENTER, EDIT AND DRILL A PROGRAM

In order to fully understand the operation of the Micromat, it is strongly advised that these instructions are followed, step by step, until the procedures become second nature to the operator. The basic controls will be dealt with first, and after becoming fully conversant with these the operator should progress to the section covering RPT, BRACKET, SIL, MOVE, and EXPAND commands.

It is assumed that the sections covering tool installation, drill depth and TV target adjustment have been read and understood.

For initial attempts at programming please use the Micromat Program Tutor which is supplied with your system.

Each time the PROGRAM mode is entered, the system will reset itself to the first block of program memory, and the first command to be entered will overwrite that first block of memory. Each subsequently entered command is placed sequentially into each succeeding block of memory. After entering the last position command the program is completed by entering an END command.

There is no requirement to 'clear' the system's memory, nor is there any means of doing so as the END command is all that is needed.

The correct order in which to enter commands is:
a) any tooling or panel registration holes.
b) followed by RPT commands if required.
c) HOLES of each required tool size along with any BRACKET commands.
d) finally press ***E*** for an END command.

**NOTE: ONLY ONE END COMMAND IS REQUIRED.**

# ENTERING DRILLING INFORMATION

***Italics*** indicate things you should do to follow this tutorial.

1) On entering the Program screen, the X and Y axes will move to their HOME. (zero) position. Two of the YELLOW WARNING bars in the TV picture border will show that the table is within 3 mm of it's limits in those directions, the Absolute and Reference coordinates will be set to Zero and a round target will appear on the TV picture. The system is ready for manual program entry.

2) Place your ***Micromat Drill Program Tutor No 1*** on the bed of the machine with the arrow pointing towards the machine's HOME position.

3) Press ***'F1'*** to see a help box with a list of available functions and commands. Press ***Enter*** or ***Esc*** to remove the help box.

4) Use the ***joystick*** to position the TV camera over the hole marked as 1 and adjust the camera ***height*** to give the picture a good, clear focus.

5) Press ***Shift/T*** and a GREEN highlight will appear. Press ***F*** and use the up and down arrow keys to adjust the focus height of the camera to give a clear picture. Press ***Enter*** when finished and the camera height will be stored for recall by just pressing ***F*** from the Program screen. Press ***'F1'*** for a list of available functions. Press ***Enter*** or ***Esc*** to remove the help box. Practice using the ***Plus*** and ***Minus*** to adjust the size and make the target fit the hole. This can be useful when routing, as the target can be made the same size as the routing cutter.
The ***number keys*** will select a different target colour to suit your preference.
Press ***Enter*** when finished and your selections will be saved and used next time the system is switched on.
Press ***Esc*** and the previous settings will be retained.

Use the ***joystick*** again to accurately centre the target over the hole.
The joystick should always be used to move the table **away** from any YELLOW warning bars to prevent the table from being driven into its limit stops. If this should happen part way through a program, the warning bars will turn RED. Press ***F4***, (HOME), and then press BST and the target will be driven to the last position of the last command which was programmed. This command must be reprogrammed before
continuing. If limits are reached at the start of a program then ***F5*** (RESET) will restore control to the joystick.

6) Press ***C*** and a GREEN highlight will appear on the Active Command. Again, help is available through '**F1**'.
Use the ***Up*** and ***Down*** arrow keys to scroll through the available program commands.
Select **HOLE** and press ***Enter.***
(An alternative method is to press **H** which sets the Active Command to HOLE.)
7) ***Press T*** and a GREEN highlight will appear on the active Tool number. Again, help is available through '**F1**'.

Use the ***Up*** and ***Down*** arrow keys to scroll through the available Tool numbers.
Select **1** and press ***Enter***.
(An alternative method is to press the **+** and **–** keys to the right of the numbers to change the Tool number.)

The **Active Command** is now set to **HOLE**
The **Active Tool Number** is now set to **1**

Each time the **Spacebar** is pressed, the command for a **HOLE** together with Tool number **1** and the current **coordinates** as shown in the Absolute display line will be entered into the current block of the system's memory. After entry, the system's memory will advance to the next block to wait for another command entry.

8) Press the ***Spacebar*** The system will bleep and the **coordinates** of the targeted hole, the Command '**HOLE**' and Tool number '**1**' will be entered into the first block of the system's memory.
The system's memory is now at it's second block waiting for a command to be entered by the next press of the Spacebar.

9) Use the ***joystick*** to move the target to the hole marked 2 and press the ***Spacebar***.

10) Move the target along the row of holes and press the ***Spacebar*** at each one until you have entered hole number 7.
Notice that each time the Spacebar is pressed, there is a short bleep and the Tool number and Command being entered flashes in the Tool and Command windows of the Reference display line.

11) Now press ***T*** and a GREEN highlight will appear on the active Tool number.
Again, help is available through '**F1**'.
Use the ***Up*** and ***Down*** arrow keys to select **2** and press ***Enter***.
(Or just press the **+** key to change from **1** to **2**)

The **Active Tool Number** is now set to **2**

12) Use the ***joystick*** to move the target to the hole marked **8** and press the ***Spacebar.***

13) Move the target along the row of holes and press the ***Spacebar*** at each one until you have entered hole number **14**.

14) To finish, simply press the ***E*** key and an ***END*** command will be added to the program.

The Micromat is now programmed to drill the 14 hole pattern which has just been entered.
The program consists of 14 **HOLE** commands and one **END** command.

The first 7 holes are on tool 1 and the second 7 are on tool 2.

Programs should always be checked for accuracy BEFORE drilling.

1) Press the **< BST** key (Back Step) once and the system will step backwards through the entered data. Remember that each time the Spacebar was pressed, the system advanced one memory block, therefore, Back Step will ALWAYS take you to the last command you entered - in this case an END command.

2) Press the **< BST** key (Back Step) again and the system will step one command backwards through the entered data for each press of Back Step. The target will move to each position and the Tool and Command window of the Reference display will show the Tool number and Command which was programmed at that position.
The coordinates of each position are also displayed.

When the first command is reached, the system will bleep 6 times.

The **> SST** key (Single Step) steps forwards through the program until the END command is reached. You cannot step past an END command.

Pressing ***F4*** drives the table to it's HOME (zero) position and has the same effect as using the joystick to move to X0.00 Y0.00

If ***F5*** (RESET) is pressed the machine will move to it's HOME position and the system will be set to the first command.

Subsequent Single Step commands will step through the program beginning with the first command of the program.

To edit the position, Tool number or Command of a particular position, use Single Step or Back Step to move the target to the position, adjust the position with the joystick if required, ensure that the Active Tool and Command are correct and then press the Spacebar.

## SEARCH

The Single Step function may also be used to SEARCH for a previously programmed position.

The normal sequential action of Single Step, moving forwards through the program, will continue to operate if the position of the table is not altered by use of the joystick or INCR buttons between presses of Single Step.

If, after having been reached a position under Single Step or Back Step control, the table is moved with either the joystick or any of the INCR buttons, the next depression of Single Step will not drive to the next sequentially programmed position but will SEARCH for the NEAREST programmed position to the current position of the table.

In this way, a programmed position may be reached for editing purposes very quickly.
The Back Step control does not work in this way and always operates in a sequential manner.

The SEARCH function can be useful in locating a position on a board where the drill may have broken and the exact start point must be found for re-drilling.

1) Replace the broken drill bit:
2) Position the TV target close to the point where the drill broke.
3) Press Single Step and the system will lock onto the coordinates of this hole.
4) Press Single Step once more and the system will move to the next position to be drilled.

Press 'F6' and Enter to go to the RUN screen from Program and when you then press 'F6' to RUN, the system will commence drilling at the correct point. This is only effective if the program has been Expanded.

## DELETE

Unwanted commands can be removed from the program by pressing DELETE immediately after the unwanted position has been reached with Back Step or Single Step. After the delete, the TV target will move forward through the program to the next position.
An END command cannot be deleted but it can be overwritten by another command.

## INSERT

Fresh information can be inserted into the program at any point by using the INS (INSERT) key and setting the insert mode to ON. New commands will be entered immediately before the **Current Command** as reached by Back Step or Single Step.
e.g. To insert a new hole between the 5th and 6th holes:
a) Use Single Step or Back Step to reach 6th hole of the program.
b) Move the target to the new position to be inserted.
c) Make sure INSERT ON is showing (Press ***INSERT***)
d) Ensure that the correct Tool number and Command is selected and press the Spacebar.
In the above example the inserted hole will become the new 6th hole. The old 6th hole will become the new 7th hole, the old 7th will become the new 8th and so on, right through the program to the END.
Practice moving various programmed positions, deleting and inserting, but initially, only attempt to move, delete or insert one position at a time, learning what happens when Single Step and Back Step are used immediately after each operation.

# CHECK

The CHECK feature allows you to check where the system will drill (or rout) by moving the TV camera to each position and hesitating before moving to the next point.
There is no drill action.

To CHECK our 14 hole program

1) Press ***F5*** to set the system to the beginning of the program.

2) Press ***T*** and set the Tool number to **1**.

3) Press ***F8*** and the camera will show all the **Tool 1** commands.
After it has finished

4) Press ***T*** and set the Tool number to **2**.

5) Press ***F8*** and the camera will show all the **Tool 2** commands.

After it has finished

6) Press ***T*** and set the Tool number to **0**.

7) Press ***F8*** and the camera will show **ALL** the commands regardless of their Tool number.

The RUN mode follows the same principle; Tool Zero will drill everything, regardless of the programmed Tool number

Tool numbers other than Zero will drill (or rout) the commands that were programmed with that Tool number.

Try reprogramming some of the positions with different tool sizes and try using the CHECK function to view the result of running with different Tool number settings.

**PRACTICE MAKES PERFECT**

# DRILLING THE PATTERN

From Program mode press ***F5*** (RESET) then press ***F6*** and ***Enter*** to go to the RUN screen

The system will go to it's HOME position, calculate the number of commands in the program and display the RUN screen.

Please unfold and refer to the RUN screen in the illustration section of this manual.

Tool numbers 3 to 15 will be DARK GRAY indicating that you can only RUN the program on tool numbers 0, 1 and 2. Tool 1 will be GREEN and offered as a default choice as we came from Program mode with the system set to the first command – a HOLE on Tool 1.

1) Use the ***Up*** and ***Down*** arrows to select the Tool number.
(Remember 0 will drill everything)

2) Replace the artwork with blank laminate and backup material.

3) Set spindle ***RPM***, ***Feed***, ***Clear*** and ***Depth*** to suit the drill size and material height.

4) Press F6

The table will go HOME, the spindle and extract systems will switch on and, after a short delay, the machine will move through the programmed positions to drill the board.
On completion of the program, the drill and extract systems will switch off and the table will return to its HOME position.

The last Tool number to be run will stay YELLOW on the screen, with a RED highlight END.
The screen will also show the time taken and the number of holes drilled.

The program will remain in the control systems memory until a new one is entered or the existing one is modified.

# THE RUN SCREEN

Select Run from the Menu screen by using the ***Up*** and ***Down*** arrow keys to move the highlight to the required function and press Enter.

Alternatively just press the underlined character of the function.
i.e. **R for RUN.**

The Run screen is used to select which Tool numbers will be drilled from the program, to program Router cutting speed and to keep track of the total number of drill strokes (Hits) that have been made by each tool. If the machine is an Auto Tool Change type, this screen is also used to program Spindle Speed (RPM) and Infeed.

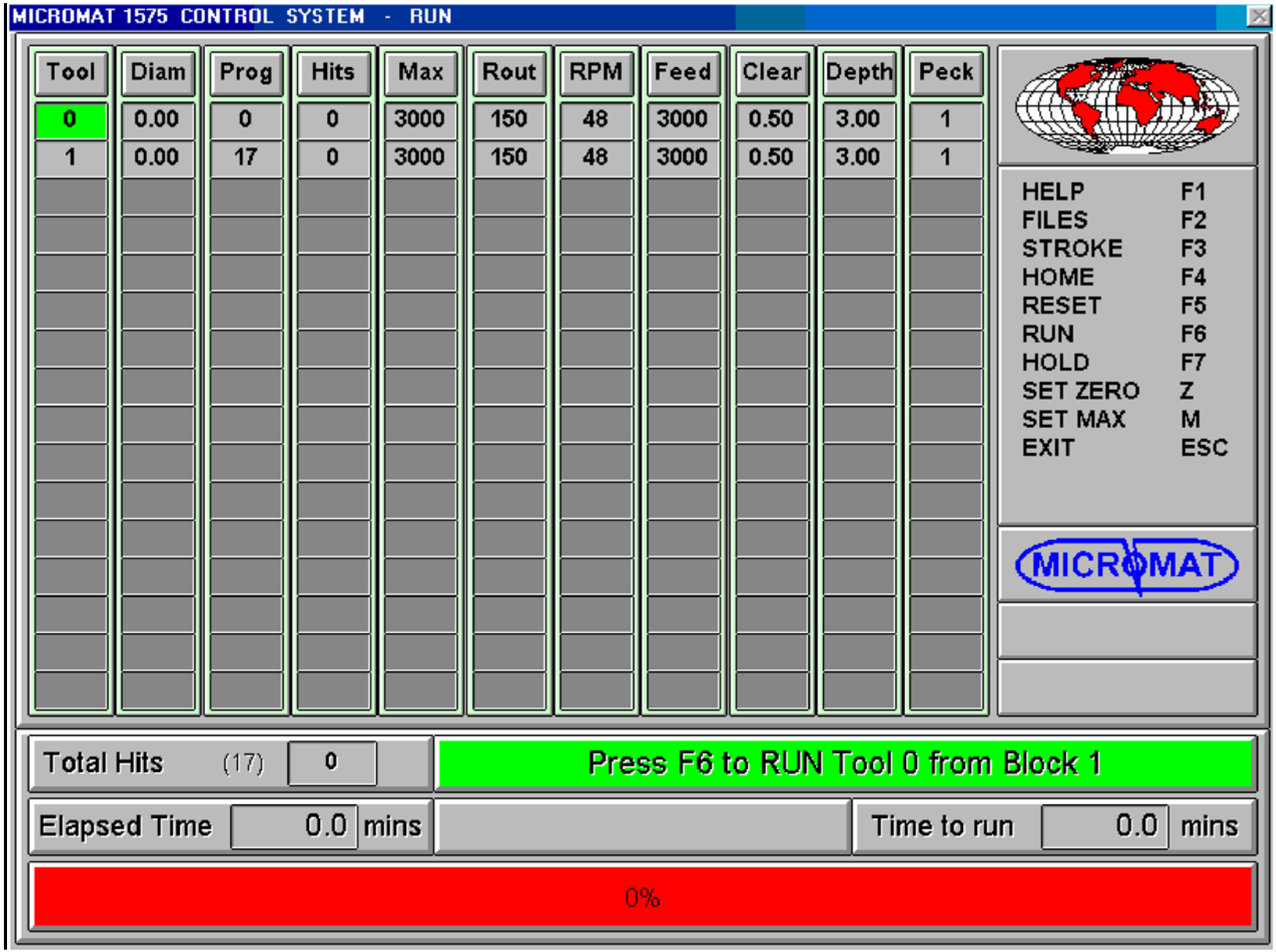
A timing system keeps track of time taken so far and gives an indication of time to run for each job.

The screen consists of a function menu panel to the right and an information panel below.

The menu functions are operated directly from the keyboard by pressing the key shown in the menu. Function keys described as 'F1' to 'F10' are those keys at the top of the keyboard and labelled as such, you should not press F followed by numbers.

In most cases, beginning a function will put a GREEN highlight on the screen and the function can be exited without changing any settings by simply pressing ***Esc***.
Whenever a GREEN function highlight is on the screen, pressing ***F1***, HELP, will give assistance with that particular function.

General help is available at the basic screen level to remind you of the available functions.


MICROMAT 1575 CONTROL SYSTEM - RUN
Tool
Diam
Prog
Hits
Max
Rout
RPM
Feed
Clear
Depth
Peck
0
0.00
0
0
3000
150
48
3000
0.50
3.00
1
1
0.00
17
0
3000
150
48
3000
0.50
3.00
1
HELP F1
FILES F2
STROKE F3
HOME F4
RESET F5
RUN F6
HOLD F7
SET ZERO Z
SET MAX M
EXIT ESC
MICROMAT
Total Hits (17) 0
Press F6 to RUN Tool 0 from Block 1
Elapsed Time 0.0 mins
Time to run 0.0 mins
0%

# RUN SCREEN FUNCTIONS AND COMMANDS EXPLAINED

Please refer to the Run screen illustration.
The list on the right of the screen contains the following functions:

**HELP** - F1

Press ***F1*** to display short help messages related to the screen or any GREEN highlighted function. Help is available for each screen and for any item which is highlighted GREEN.
Press ***Enter*** or ***Esc*** to remove the help message from the screen.

**FILES** - F2

Pressing ***F2*** loads the Files screen to allow you to LOAD or SAVE a data file.
When you leave the Files screen you will return to Run.
See FILES SCREEN.

**STROKE** - F3

Each press of ***F3*** starts the spindle, waits for the spindle speed to wind up and then operates the drill head through one complete drill stroke to enable drill depth and feed rate to be checked.

**HOME** - F4

Pressing ***F4*** drives both axes of the machine to their HOME (datum zero) position.

**RESET** - F5

An ***F5*** (RESET) command sets the system to the FIRST command of the program and sends the machine to its HOME position.

**RUN** - F6

Pressing ***F6*** will start a drill or rout program from the point shown in the message box above the Time to run display.

**HOLD** - F7

Temporarily stops the Run function. A second press resumes movement. If ***Esc*** is pressed while HOLD is on the program will be stopped completely and shut down the spindle and extract systems.

**SET ZERO** - Z

Pressing ***Z*** will zero the Total Hits display.
Pressing ***Shift Z*** will zero the Hits displays for each Tool number.
If the GREEN highlight has been moved across the screen to Hits or across to Peck then pressing ***Z*** will set these numbers to zero or to their lowest possible setting. To set RPM to Zero press 0

**SET MAX** - M

If the GREEN highlight has been moved across the screen to Hits or across to Peck then pressing ***M*** will set these numbers to their Maximum values.

If the GREEN highlight is in the Tool column pressing ***Shift M*** will set the screen to a series of default values

**EXIT** - Esc

If a program is being executed, the Esc key will stop the program completely and shut down the spindle and extract systems.
If not executing a program the Escape key offers a return to either the Menu screen or to the Program screen. Press ***Enter*** to go to the MENU screen or ***P*** to go to the Program screen. ***Esc*** once again to cancel the command and stay in the Run screen.

**ARROW KEYS**

The ***Up*** and ***Down*** arrow keys move the GREEN cursor up and down the Tool number column. Any rows which are shaded DARK GRAY indicate Tool numbers which do not exist in the program. Only Tool numbers which do exist can be selected.
Once a Tool number has been selected, ***F6*** will run the program or the ***Right*** and ***Left*** arrow keys will move the GREEN cursor to the Hits, Max and Rout columns.
When the system is running, the GREEN cursor can be moved to the right to alter the values on the fly for the active tool number.

**DIAM**

Press ***F1*** for help on this topic.
Use this column to set the diameter of the tool.
If Rout speed, RPM and In-feed have already been saved as preferences for this diameter then pressing **D** will recover the parameters for Drill bits, **R** will recover the parameters for Routing tools.

**HITS**

Press ***F1*** for help on this topic.
This column shows how many drill strokes this particular tool has made. When the GREEN cursor is in this column the ***Up*** and ***Down*** arrow keys will change the value in steps of +100 to allow a part used drill to be utilised and its Hits-to-date entered.
The number cannot be set higher than **Max** for that Tool number.
Press ***Z*** to zero the number.
Press ***M*** to set the value to the system maximum.
Press ***A*** and all the columns will be set to the same value.
While the system is running, the Hits number for each tool will count up as the tool is used. When the Hits or Distance number reaches the Max number, the system will stop and prompt the operator for a new tool.
When the tool has been replaced, the operator can use the ***Up*** and ***Down*** arrow keys to set the new Hits value for the tool, if it has already been used, and press ***Enter*** to carry on with the run.
If ***Enter*** is pressed **without** using the Up and Down arrow keys, then the Hits will be set to zero and the run will continue with the new tool.

**MAX**

Press ***F1*** for help on this topic.
This column shows how maximum number of drill strokes this particular tool is allowed to drill or for routers the number of millimeters it is allowed to rout before it requires changing.
When the GREEN cursor is in this column the ***Up*** and ***Down*** arrow keys will change the value in steps of +100 to allow different settings to be made according to the particular tool size being used. Press ***M*** to set the number to a system default of 3000.
Press ***A*** and all the columns will be set to the same number.

**ROUT**

Press ***F1*** for help on this topic.
This column shows the cutting speed in Metres per minute for each particular tool.
When the GREEN cursor is in this column the ***Up*** and ***Down*** arrow keys will change the value in steps of +0.05 to allow different settings to be made according to the particular tool size being used.
Press ***M*** to set the value to the system maximum.

**RPM**

Press ***F1*** for help on this topic.
Use the up and down arrow keys to set the RPM for this tool.
Press 0 to set the RPM to zero to turn off this tool number when RUN (F6) is pressed
Press Z to set to the minimum speed of 20,000
Press M to set to the system maximum of 60,000

**FEED**

Sets the in-feed of the spindle for the working stroke between Workheight and Depth
Press ***F1*** for help on this topic
Press ***Z*** to set the value to the minimum of 100.
Press ***A*** and all the columns will be set to the same value.
Press M to set to the system maximum

**CLEAR**

Sets the clearance distance above the Workeight setting at which the machine will travel between holes.
Press ***F1*** for help on this topic
Press ***Z*** to set the value to the minimum of 0.02mm.
Press ***A*** and all the columns will be set to the same value.
Press M to set to the system maximum which is the maximum drill stroke available less the Workheight

**DEPTH**

Sets the depth of the working stroke below Workheight
Press ***F1*** for help on this topic
Press ***Z*** to set the value to the minimum of 0.02mm.
Press ***A*** and all the columns will be set to the same value.
Press M to set to the system maximum which is Workheight
This can not be set to more than the Workheight value and if Workheight is reduced below the Depth setting then Depth will be reduced.

**PECK**

Sets the number of steps for the Z axis to travel over it's working stroke between Workheight and Depth or the number of passes the machine will make to attain the setting in Depth when routing.
Press ***F1*** for help on this topic
Press ***Z*** to set the value to the minimum of 1.
Press ***A*** and all the columns will be set to the same value.
Press M to set to the system maximum which will be Depth / 0.01 up to a maximum of 99.

**TOOL NUMBER**

The Tool number is used to program different hole sizes by allocating each size a different number. Only those holes programmed with a particular number will be drilled if the Tool number is set to that number when F6 is pressed. The Tool number is allocated to each command when it is programmed by pressing the Spacebar or by using the INCR buttons.

The Tool number used at the time a particular command is programmed, is the Active Tool Number and is displayed in the Tool window of the Absolute display line.

REPEAT, OPEN and CLOSE commands will automatically be programmed with a Tool number of 0 (zero).

Tool numbers can be entered in any order and in any combination of sizes, the only exception being that routing commands for a given cut must all be programmed sequentially and with the same Tool number.

**DO NOT press F5 or enter END commands between each tool size.**

After entering a program, using Back Step and Single Step will display the programmed Tool number in the Tool window of the Reference display line, and if any positions are to be reprogrammed then care should be taken to ensure that the correct Tool number is used.

## RUN AND THE TOOL NUMBER

If the machine is an Auto Tool Change type and the Tool number is set to 0 (zero) when F6 is pressed, Auto Tool Change operation will begin and ALL the holes will be drilled, starting with tool number 1, or the lowest allocated Tool number, and finishing with the highest allocated Tool number.

If any holes were programmed with the Tool number set to 0 (zero), then they will be drilled with **each** tool. This feature can be used to pilot drill large holes if you use the lower Tool numbers for the smaller drill sizes..

A particular tool will be picked up ONLY if the Spindle Speed has been entered and is greater than 0 for that tool number. If Spindle Speed data has NOT been entered for a particular tool number then NONE of the holes for that tool number will be drilled.

Manual Tool Change machines will drill ALL the holes in Tool number order and in the order in which they were programmed with whatever tool is in the spindle if **F6** is pressed with the Tool number set to 0 (zero).

If **F6** is pressed on either a Manual Tool Change machine or an Auto Tool Change machine set to manual by pressing 'A' and the Tool number is set to a number from 1 to 15 then only those holes programmed with that number will be drilled and NO AUTO TOOL CHANGE WILL TAKE PLACE. Again, any holes which were programmed with the Tool number set to 0 (zero) will be drilled with **each** tool.

If **F6** is pressed on an Auto Tool Change machine set to auto by pressing 'A' and the Tool number is set to a number from 1 to 15 then the set Tool number, and all succeeding Tool numbers, will be run and the Auto Tool Change system will operate normally.

The tool currently fitted in the collet will be used and if the machine is an Auto Tool Change type, BEWARE it may be the Keeper so use INIT to fit the correct tool into the collet because the Keepers don't drill holes very well and they certainly don't rout!.

The Tool number has a similar effect on the CHECK procedure.

**PROG - RUN**

Both the RUN and CHECK modes can be started at points other than the very beginning of programs. (i.e. other than block 1).

At the Program screen, use Single Step and Back Step to reach a specific command in the program.

Pressing CHECK, ***F8***, will move the target through the program beginning with the command which was reached with the Single Step and Back Step controls and was shown on the TV picture as above. The system will hesitate and show each point as though it was being drilled. Pressing ***F7*** will toggle HOLD on and off and pressing ***Esc*** will exit the CHECK mode.

Pressing RUN, ***F6*** and Enter, will go to the Run screen and pressing ***F6*** will start the run from the indicated Tool and Block numbers, i.e. the command which was reached with the Single Step and Back Step controls and was shown on the TV picture. In Manual mode only the tool number indicated will be run.
The starting Block number will revert to 1 if the Tool setting is altered by using the Up and Down arrow keys. The on screen message will indicate the starting Tool and Block number.

If the machine has an Auto Tool Change system then the corresponding tool will be picked up before drilling commences and the run will continue through succeeding tool numbers until the End. The on screen message will indicate the starting tool and block number.

Pressing A will toggle the Auto Tool Change mode between on and off
IMPORTANT: If the program contains any bracket commands it must only be RUN from one of the OPEN bracket commands unless there are any Repeat commands, in which case it must only be RUN from one of those Repeat commands. An Expanded program may be run from any command.

A broken drill can be replaced and the program restarted from the position after where the break occurred by using the Search function to find the point at which the tool broke, pressing Single Step once and then pressing ***F6*** and Enter to go to the RUN screen and commencing the run by pressing ***F6*** once more.

**REPEAT PATTERNS**

The REPEAT command is used for step and repeat programs where more than one identical circuit pattern is to be drilled on one large panel.

First, identify the first hole to be drilled on each circuit and program each of these using the REPEAT command. Program the last of these as a REPEAT and also as a HOLE (or BRACKET etc.) Then program the rest of the last pattern normally as HOLES, including any BRACKET commands if required (see below), finishing with a single END command.

When Back Step and Single Step are used, only the REPEAT positions will be shown on all but the last circuit, the whole of the last circuit will be shown, unless bracket commands have been used (see below), since this one was programmed as the master pattern.

OPEN and CLOSE brackets are used where a pattern, or patterns, are repeated within a complete circuit (e.g. for DIL packages).

First, identify the first hole to be drilled in each pattern and program each of these using the OPEN bracket command. Program the last of these common holes as OPEN and also as a HOLE. Then program the rest of the last pattern normally as HOLEs, followed immediately by a CLOSE bracket at the same position as the last HOLE before entering further individual HOLEs or more sets of brackets.

The only way to show where the machine will drill on the first circuits of a REPEAT or BRACKET program is to use the CHECK function where each circuit will be shown on the monitor. In this way the accuracy, or otherwise, of step and repeated artwork may be checked and corrected if necessary.

There is no limit to the number of REPEAT commands that can be entered, but they must be at the start of patterns. Any holes which are not to be step and repeated must be entered immediately before any REPEAT commands and will be treated by the machine as individual holes.

The Tool number setting is irrelevant for REPEAT and BRACKET commands as they are automatically entered as Tool zero. When the program is in the RUN mode, any REPEAT and BRACKET commands will always be required whatever Tool number setting is used for RUN.

**SINGLE - IN - LINE ( SIL )**

The SIL feature allows rows of up to 999 commands to be accurately and equally pitched over any required distance. Full linear interpolation exists within the operating software so that the row of commands may be pitched in any direction on the machine's table and not just parallel to the X and Y axis.
The "SIL" function is of particular use for edge connectors and DIL packages etc. where the distance between holes, and their overall spacing, is more important than the position of the individual holes with respect to their own particular pad centres.

Operation of the function is very simple. The first hole of the row is identified, targeted, and its coordinates entered as a normal HOLE. Next, move the TV target **accurately** to the last hole in the row. When the position is satisfactory, press ***S*** and ensure that the number shown in the SIL window is correct.
Then press ***Enter*** and the machine will move over the row and enter a HOLE at each position, or press ***Esc*** to cancel the SIL function..

The number of positions can be altered by using the ***Up*** and ***Down*** arrow keys before pressing the ***Enter*** key.

The machine calculates the correct number of holes by using 2.45mm (0.1") as a reference measurement.

NOTE: Points are not spaced on a 2.54mm (0.1") grid, the spacing will depend on the position of the start and finish and the number of holes to be placed.
If you know that the holes are not on a 2.54mm (0.1") pitch, or are just not sure of the spacing, then after the first position has been accurately placed and entered, move to the second position of the row, accurately position the target and press ***G***. The linear distance from the first hole will be recorded and used to calculate the total number of holes when the last position is reached.

The SIL function is not limited to the HOLE command. The Active Command and Tool number are used for the whole row. The SIL function may therefore be used for any command e.g. a row of REPEAT or OPEN commands

No limit exists as to the number of times this function may be used within a program other than that the total number of positions stored does not exceed the total amount of memory available in the system. The commands entered are just the same as those entered manually and can be stepped through and edited just as normal commands.

## PROGRAM MOVE AND EXPAND

These functions are helpful to the programmer in that they allow patterns to be moved around the drilling bed of the Micromat and to be repositioned to make the best use of laminate blanks.

The MOVE routine simply repositions a drilling or routing pattern, complete with any REPEAT or bracket commands.

The EXPAND routine is not only able to reposition the pattern relative to REPEAT commands, but it will remove any REPEAT and BRACKET commands and re-enter the program as though it had been entered as individual commands for EVERY position and therefore editable.

EXPAND only operates on a complete entered program. Everything is changed, from the first block of data in memory to the END command.
The MOVE routine operates from current command within a program, and will move everything from that point to the end command.

## PROGRAM MOVE

### MOVING A COMPLETE PROGRAM

1) Load the drill program and go to the Program screen.
2) Single Step or Back Step to the first command in the program.
3) Use the joystick to place the TV target over the new position for the first command. (The first command will be repositioned here, with everything else relative to it.)
5) Press ***F10*** and wait for the Moved message.
6) The system will return to the Program mode with the target at the first command which has been repositioned

### MOVING PART OF A PROGRAM

The procedure is just as above except that in 2 above, the SST and BST controls should be used to reach a particular command in the program. Repositioning is carried out in the same way and the result will be that everything from the start of the program up to that command will remain as before.
The command, and everything following it up to the END, will be moved, and the TV target will indicate the new position of that command.

**CAUTION**
The operator must ensure that the moved program will still fit within the limits of the drilling table.

**PROGRAM EXPAND**

This function is used to EXPAND programs from quick to enter step and repeat patterns (using REPEAT and bracket commands) and to convert those step and repeated coordinates into their actual coordinates as they will be drilled, occupying a much larger amount of the Micromat's memory. This allows each position to be reprogrammed individually to allow for any artwork step and repeat irregularities.

Consider a drilling program consisting of **10** REPEAT commands, **10** OPEN bracket commands, **14** HOLE commands, **1** CLOSE command and **1** END command.

It occupies 36 blocks of memory but will drill 1400 holes (10 x 10 x 14 = 1400)
Its expanded version will require 1401 blocks of memory.
i.e.. 1400 HOLE commands and one END command.

The EXPAND routine converts the coordinates by calculating the relative offset for each bracket and REPEAT group and adding this offset to positions within each group, to produce new sets of coordinates around every REPEAT and OPEN command encountered. An END command is added after conversion.

The Micromat must be correctly programmed using REPEAT and BRACKET commands such that it would drill the required pattern in the normal way.
Press ***F9*** to start the Expand function, then press ***C*** to just calculate the size of the expanded program or press ***Enter*** to actually expand the program. In either case, two numbers will be shown. The first is the number of commands in the original program, the second is the number of commands in the expanded version.

If the system does not have enough memory available to expand the program, a message will indicate the problem, the original program will remain intact and the board will have to be drilled using the original step and repeat program.
If enough memory is available the Micromat will compute the new program and write it into memory in place of the old step and repeat program. The target will move to the first command after expansion.

**THE FILES SCREEN**

Select Files from the Menu screen by using the ***Up*** and ***Down*** arrow keys to move the highlight to the required function and press Enter.
Alternatively just press the underlined character of the function.
i.e. **F for FILES.**

The Files screen can also be accessed from both the Program screen and the Run screen by pressing ***F2***

The screen is used to control the transfer of drilling and routing programs in and out of the system on floppy disk. It also allows unwanted files to be deleted and is capable of formatting 360Kb, 1.2Mb, 720Kb and 1.44Mb floppy disks.

Access is also provided to MM-PLOT, our CAD Data Transfer software which reads CAD drill data in any format and includes probably the best drill path optimiser in the industry.

The initial FILES screen consists of a representation of the two disk drives on the front panel of the Micromat function menu panel to the right and an information panel below.

When a function is selected, a more detailed screen will appear with full instructions for each function.

In most cases, beginning a function will put a GREEN highlight on the screen and the function can be exited without changing any settings by simply pressing ***Esc***.

Whenever a GREEN function highlight is on the screen, pressing ***F1***, HELP, will give assistance with that particular function.
General help is available at the basic screen level to remind you of the available functions.

**DATA FORMAT**

Data is stored on a one command/one line basis. and a short drill file is shown below
If data is saved when the line beneath the filename window shows **MA** the data will be saved in Micromat ASCII format as detailed below. This has the same command structure as the binary format but is viewable with a normal text editor such as Notepad

| | |
|---|---|
| MAS | header |
| X000254Y000254T1C3 | Run screen data for T1 X = Diam Y = Rout |
| X000254Y000254T1C5 | Run screen data for T1 X = RPM Y = Feed |
| X000254Y000254T1C13 | Run screen data for T1 X = Clear Y = Depth |
| X000254Y000254T1C14 | Run screen data for T1 X = Peck |
| X000254Y000254T1C12 | hole at X2.45 Y2.54 Tool 1 |
| X000508Y000254T1C12 | hole at X5.08 Y2.54 Tool 1 |
| X000762Y000254T1C12 | hole at X7.62 Y2.54 Tool 1 |
| X001056Y000254T1C12 | hole at X10.56 Y2.54 Tool 1 |
| X000000Y000000T0C15 | End command (X,Y and T all 0)# |

X and Y coordinates are all millimetres x 100 with an implied decimal point
i.e. X 013357 = 133.57 mm
Tool numbers are from 0 to 15
Command codes
0 = reserved for future use
1 = reserved for future use
2 = reserved for future use
3 = Run screen data X = Diam Y = Rout
4 = Repeat
5 = Run screen data X = RPM Y = Feed
6 = Open Bracket
7 = Close Bracket
8 = Down
9 = Up
10 = Centre CCW
11 = Centre CW
12 = Hole
13 = Run screen data X = Clear Y = Depth
14 = Run screen data X = Peck
15 = End

## FILES FUNCTIONS EXPLAINED

Please refer to the Files screen.
The list on the right of the screen contains the following functions:

### **HELP** - F1

Press ***F1*** to display short help messages related to the screen or any GREEN highlighted function. Help is available for each screen and for any item which is highlighted GREEN.
Press ***Enter*** or ***Esc*** to remove the help message from the screen.

### **EXIT** - Esc

Pressing the ***Esc*** key will close the Files screen and return control to whichever screen initiated Files.
If you arrived at the Files screen by pressing ***F2*** from the Program screen, then when you press ***Esc*** you will be returned to the Program screen.
The following commands are also active:

### ARROW KEYS

The ***Left*** and ***Right*** arrow keys change the selected disk drive between drive **A** and **B**.
Pressing ***A*** or ***B*** has the same effect.
The ***Up*** and ***Down*** arrow keys change the function described on the GREEN strip across the centre of the screen and allow the selection of one of the five options.
The selected option is accessed by pressing ***Enter***.

### LOAD A MICROMAT FILE FROM DISK A or B

After selecting the disk drive, ***A*** or ***B***, press ***Enter*** and the screen will log to the selected disk drive, which should obviously contain a disk. The directory list of the disk will appear and the screen will show full instructions for selecting a file and loading it into the system.
If the file is not Micromat format, the system will automatically switch to MM-PLOT and attempt to convert the data into a useable format. The data must however be drill data.
Please refer to the MM-PLOT manual to use the available facilities. When you are satisfied with the result save the data using the default filename of **WORK.MMM** (just press *Enter*)
**Any other name will not work.**
On return to the Disk screen, WORK.MMM will be the Micromat format version of the originally un-recognised file and this will be loaded into the control systems memory. If you wish to give it a different name then simply use the SAVE function and then delete WORK.MMM to avoid confusion.

**LOAD APPEND**

Programs are normally loaded individually. Pressing F2 or F3 when the File List window is highlit will allow a second (or third etc) program to be appended to the previous program. F2 will append the new program and merge similar Tool Size, F3 will append but create fresh tool numbers.
F4 will cancel the Append operation.
Press ***Esc*** to exit the LOAD function

**SAVE A MICROMAT FILE TO DISK A or B**

After selecting the disk drive, ***A*** or ***B***, press ***Enter*** and the screen will log to the selected disk drive, which should obviously contain a disk. The directory list of the disk will appear and the screen will show full instructions for saving a file.
Since the system of file selection is a basic "Point and Shoot" set up, a new filename will not yet exist and so you must choose one of the existing names, press ***Enter*** and then answer ***N*** to OVERWRITE? and type a new name. You may, of course, want to overwrite the old program with the new data.
At the point the system states "Press ENTER to SAVE" you may press “A” which will toggle MA on and off under the filename window. With **MA** displayed, files will be saved in Micromat ASCII format (MMA) and will have **.mma** appended to the filename.

They can be edited or written using a text editor. Files saved in MMA format can be automatically loaded back into the machine with the LOAD function

When **MA** is not displayed files, will be save in binary format and will not be readable with a text editor.

Pressing "S" and/or "E" will toggle saving files in Sieb & Meyer Format 1000 and/or Excellon Format2 in addition to the selected Micromat format. Only drill files may be saved in S or E formats, routing commands are not supported.

Normal MS-DOS rules apply for filenames and they must be a maximum of 8 alpha numeric characters, optionally followed by a period and then up to 3 more characters.
e.g. abcdefgh.123

If just a name of up to 8 characters is given, the system will automatically append **.mma** to the name if MA is displayed. ( .**mmm** if not )

**LOAD A MICROMAT FILE FROM NETWORK**
**SAVE A MICROMAT FILE TO NETWORK**

These functions can be accessed by pressing **N.**
They are the same as the floppy disk functions but the Network Drive must already have been specified on the ***Utils 1***screen.
If the drive letter in the ***Utils 1***screen is set to **C** then the Network Drive is set to C:\drilling
Any other drive must be fully specified on the ***Utils 1***screen.

## DELETE A DISK FILE

After selecting the disk drive, ***A*** or ***B***, press ***Enter*** and the screen will log to the selected disk drive, which should obviously contain a disk. The directory list of the disk will appear and the screen will show full instructions for deleting a file.
Select the file you want to delete and press ***Enter***.
Answer ***Y*** if you're sure and then use ***Esc*** to leave the Delete function.
Otherwise answer ***N***.

## FORMAT A FLOPPY DISK

After selecting the disk drive, ***A*** or ***B***, press ***Enter*** and the screen will log to the selected disk drive, which should contain a disk. The screen will show full instructions for formatting a floppy disk.
Just follow the prompts and press ***Esc*** to leave the function and return to the basic Files screen.

## MM-PLOT CAD COMPATIBLE SOFTWARE

Press ***Enter*** and the screen will log to MM-PLOT to allow the loading and manipulation of CAD data files from floppy disk.
The converted data will be saved back to floppy disk and can then be loaded into the Micromat control system using the LOAD function.
MM-PLOT also contains a drill path optimiser.

Please copy this page and make a note of the settings for your machine to use for future reference or in case the control system has to be rebuilt.